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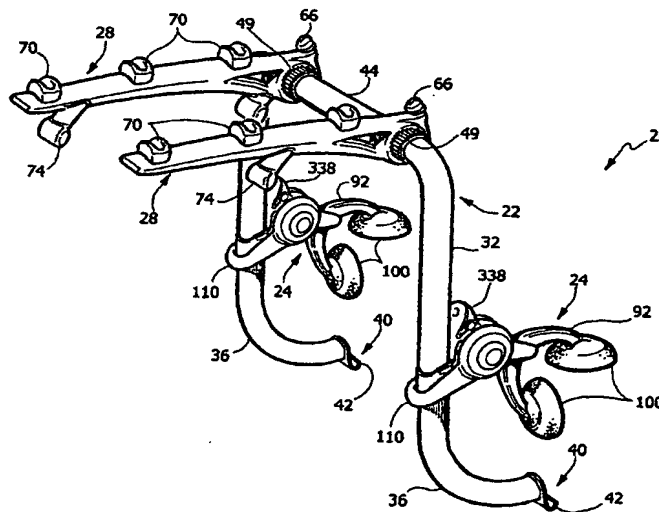
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(54) Title: **VEHICLE-MOUNTED EQUIPMENT CARRIER**



(57) Abstract: An equipment carrier for mounting onto a rear component of a vehicle structure, such as a vehicle trunk lid or door, comprises a frame having lower engagement elements engageable with a lower area of the vehicle component, a structure connected to the frame for carrying one or more items of equipment, at least one vehicle engaging member, connected to the frame, for engaging the vehicle component at a position above said lower area, a strap member having upper engagement elements for engagement with an upper area of the vehicle component, and at least one support connected to the frame, provided with a strap engaging and tensioning mechanism, which is engaged by the strap member and can be controlled for tensioning the strap member in order to tighten the upper and lower engagement elements onto the upper and lower areas of the vehicle component.

**"VEHICLE-MOUNTED EQUIPMENT CARRIER"****BACKGROUND OF THE INVENTION**

5       The present invention relates to equipment carriers, such as carriers for bicycles, skis, luggage or the like, which are to be mounted onto a vehicle trunk lid or door.

10       Carriers of this type are encountering increasing favour among users with respect to carriers which are to be mounted on the vehicle roof, also due to the inconvenience of placing the equipment (e.g. a bicycle) on the vehicle roof, particularly with relatively tall vehicles such as Sport Utility Vehicles (SUV), vans or  
15 others.

      It is particularly important for an equipment carrier of the type to be mounted on a trunk lid or door that it can be mounted and removed with very quick and simple operations by the user. Equipment carriers  
20 of this type which have been proposed heretofore are not able to solve this problem very satisfactorily. A conventional equipment carrier for mounting on a vehicle trunk lid or door comprises a frame with a structure for carrying one or more items of equipment  
25 and provided with engagement means for engaging the rear trunk lid or door of the vehicle. In order to safely secure the carrier to the vehicle, a number of straps or belts are provided which are used to connect the frame of the carrier to the vehicle structure. The  
30 operation of arranging these straps is relatively complicated and time-consuming, and the same is true when the carrier must be removed from the vehicle. Moreover, the addition of these straps gives rise to a not very attractive appearance of the carrier once it  
35 has been mounted on the vehicle.

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**SUMMARY OF THE INVENTION**

It is an object of the present invention to  
5 provide an equipment carrier for mounting on a vehicle  
trunk lid or door which can be mounted on the vehicle  
and removed from the vehicle with extremely simple and  
quick operations.

It is also an object of the present invention to  
10 provide an equipment carrier of this type which does  
not imply the use of separate belts or straps in order  
to secure the carrier on the vehicle structure.

It is also an object of the present invention to  
provide an equipment carrier for mounting on a vehicle  
15 trunk lid or door which ensures the carrier to be  
safely secured to the vehicle structure.

Another object of the invention is that of  
providing an equipment carrier for mounting on a  
vehicle trunk lid or door which is suitable for  
20 carrying a variety of different items of equipment.

According to the invention, these and other  
objects are achieved by providing an equipment carrier  
having the features specified in any of the attached  
independent claims. Further preferred features are  
25 indicated in the dependent claims.

The invention is particularly directed to an  
equipment carrier for mounting onto a rear component of  
a vehicle structure, such as a vehicle trunk lid or  
door, comprising:

- 30     - a frame having lower engagement means engageable  
with a lower area of the vehicle component;  
       - a structure connected to the frame or forming  
part thereof, for carrying one or more items of  
equipment;

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- at least one vehicle engaging member connected to the frame or forming part thereof, for engaging the vehicle component at a position above said lower area,

5 - a strap member having upper engagement means for engagement with an upper area of the vehicle component,

- at least one support connected to the frame or forming part thereof, and having strap tensioning means, preferably in form of ratchet-type means, which are engaged by said strap member and can be controlled  
10 for tensioning the strap member in order to tighten said upper and lower engagement means onto said upper and lower areas of the vehicle component.

In a preferred embodiment, the above mentioned vehicle engaging member for engaging the vehicle  
15 component is connected to, or forms part of, the support having the ratchet-type means for tensioning the strap member.

In the carrier of the invention, one or more strap members may be provided engaged with respective  
20 ratchet-type means, so that the strap members appear to constitute an integral part of the whole carrier.

In order to mount the carrier on the vehicle, the frame of the carrier is simply placed with its lower engagement means engaged for instance on the lower edge  
25 of the rear trunk lid or door of the vehicle. One or more vehicle engaging members carried by the frame rest on the trunk lid or door and each strap member is arranged with its upper engagement means on the upper edge of the trunk lid or door. Then, each strap member  
30 can be tightened easily and quickly by the above mentioned ratchet-type tensioning means, so that the lower engagement means of the carrier frame are pressed into engagement against the lower area of the trunk lid or door, while the upper engagement means of the strap

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members are urged into engagement with the upper edge of the lid or door.

In a further preferred embodiment, each support carrying the strap tensioning means is provided with  
5 strap winding means for storing the strap member in a wound condition within the respective support. Thus, the carrier and the strap members integrated therein assume a particularly compact configuration when the carrier is not in use, whereas the strap members can be  
10 easily unrolled from the respective supports when the carrier must be mounted.

According to a further preferred feature, the above mentioned vehicle engaging member for engaging the vehicle component is in form of a rocking member  
15 pivotally mounted with respect to the frame around a pivot axis and having two end engaging feet for engaging the vehicle component, which preferably are also swingable relative to the rocking member. In the mounted condition of the carrier, the lower engagement  
20 means of the frame are engaged with the lower area of the trunk lid or door, the two end engaging feet of the above mentioned rocking member are engaged with the lid or door and the upper engagement means of the strap members are engaged on the upper area of the trunk lid  
25 or door. Due to the above described arrangement, when the strap members are put under tension, the frame of carrier is subjected to a tilting torque around the above identified pivot axis with respect to the above mentioned rocking member, which is then firmly urged in  
30 a fixed position against the surface of the vehicle trunk lid or door. Thus, even when the tensioned strap members have a substantially horizontal orientation, such as on sedan cars having a trunk lid with a substantially horizontal surface, the lower engagement  
35 means are in any case safely urged strongly into

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engagement on the lower area of the vehicle trunk lid or door. This constitutes a further important advantage of the carrier according to the invention.

5 **BRIEF DESCRIPTION OF THE DRAWING**

Further features and advantages of the invention will become apparent from the following description with reference to the annexed drawings, given purely by  
10 way of non limiting example, in which:

Figure 1 is a perspective view of a first embodiment of the invention, in a configuration adapted to be used as a bicycle carrier, where the strap members have been eliminated for better clarity of  
15 illustration,

Figure 2 is a further perspective and partially exploded view of the carrier of figure 1,

Figure 3 is a side view of the carrier of figures 1, 2,

20 Figure 4 is a front view of the carrier of figures 1-3,

Figure 5 is a view at an enlarged scale of a detail of figure 2,

25 Figure 6 is a view at an enlarged scale of a further detail of figure 2,

Figure 7 is a detail at an enlarged scale of figure 3,

Figure 8 is a cross-sectional view of the detail of figure 7,

30 Figure 9 is a perspective view showing the first embodiment in a folded condition within a case,

Figure 10 is a perspective view showing the first embodiment of the carrier of the invention mounted on a station-wagon,

35 Figure 11 is a perspective view showing the first embodiment mounted on a sedan car,

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Figure 12 is a perspective view of the first embodiment of the carrier of the invention in a version for transporting a piece of luggage, where the strap members have been eliminated for better clarity of illustration,

Figure 13 is a perspective view of the first embodiment in a version adapted for transporting skis and/or snowboards, where also the strap members have been eliminated,

Figure 14 shows a variant of figure 13,

Figure 15 is a perspective view of a second embodiment of the invention in a version adapted to be used as bicycle carrier,

Figure 16 is a perspective view of the second embodiment in a version adapted for ski transportation,

Figure 17 is a side view of the second embodiment, where the ski support members and the bicycle support arms have been eliminated,

Figure 18 is a cross-sectional view at an enlarged scale taken along line XVIII-XVIII of Figure 23,

Figure 19 is a cross-section taken along line XIX-XIX of Figure 18,

Figure 20 is a cross-section taken along line XX-XX of Figure 17,

Figure 21 is a cross-section taken along line XXI-XXI of Figure 20,

Figure 22 is a cross-section taken along line XXII-XXII of Figure 18,

Figures 23,24 are partial rear and front views of the carrier of the second embodiment,

Figures 25,26 are perspective views showing the second embodiment in a mounted condition on a station-wagon and a sedan car respectively, where the ski support members and the bicycle support arms have been eliminated for better clarity of illustration,

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Figure 27 shows a perspective exploded view of the lower hook arrangement of the carrier, according to a preferred embodiment, and

Figure 28 shows a further variant of the carrier.

5

#### DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

With reference to figures 1-9, a first embodiment of the invention is shown therein, in form of an equipment carrier 20 adapted for mounting to a vehicle for supporting various items on the exterior of the vehicle. Equipment carrier 20 generally includes a frame 22, a pair of supports 24 each of which includes a strap 26 (see in particular figures 2,3,7), and a load-carrying arrangement engaged with frame 22, e.g. a pair of support arms 28.

In the illustrated embodiment, frame 22 includes a pair of upright sections 32 having forwardly facing spaced indentations 34. A curved lower section 36 extends from the lower end of each upright section 32, and terminates in a forwardly facing end 38. An engagement member 40, which includes a hook 42 at its lower end, is engaged with the forwardly facing end 38 of each lower section 36.

A cross-member 44 extends between and interconnects the upper ends of upright sections 32. Cross-member 44 includes provisions for mounting the equipment-carrying component(s) of carrier 20. In one embodiment, cross-member 44 includes indentations 46, 48 (see figures 2,5). An engagement member 49 includes a pair of shell sections 50 which are engaged with cross-member 44 at each set of indentations 46, 48, and which fit together to encircle cross-member 44. Each shell section 50 includes a mounting boss 52 (see figure 5) which is received within one of indentations



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46, 48 so as to locate shell sections 50 on cross-member 44 and to prevent rotation of shell sections 50. Transverse, radially spaced ridges 56 are formed on each shell section 50.

5 Each support arm 28 includes a hub section 56 having a transverse passage 58. (see figures 2,5). Hub section 56 has a split end construction, and includes a barrel 60 on one end and a receiver 62 on the other. A nut is engaged within receiver 62. A series of  
10 radially spaced inwardly extending transverse teeth 64 are formed about the periphery of passage 58. Teeth 64 are adapted to engage ridges 54 of shell sections 50, such that arm 28 can be engaged with cross-member 44 in varying angular orientations. Hub section 56 is slid  
15 axially onto engagement member 49 in a desired axial orientation. A screw 66 is inserted through barrel 60 and into engagement with nut 63 located within receiver 62, and is tightened so as to clamp hub section 56 onto engagement member 49 and to retain arm 28 in position  
20 on engagement member 49.

In the illustrated embodiment, support arms 28 include structure for supporting equipment such as a number of bicycles in a suspension-type manner, in the form of saddles 68 having pads 70 engaged therewith. A  
25 retainer strap (not shown) is engaged with each saddle 68 and is adapted to encircle a component of an item of equipment, e.g. a bar or tube of a bicycle frame, to engage the item of equipment with support arm 28 in a known manner. Arms 28 include stabilizing members 74  
30 for preventing the bicycles from swinging when suspended by engagement with saddles 68.

Each support 24 is formed by a pair of support sections 78, 80 (figures 2,6) which fit together in a clamshell-type manner. Support sections 78, 80 include  
35 respective channels 82, 84, which encircle frame

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upright section 32 and define a passage in close tolerance to the outer surface of upright section 32. With this construction, each support 24 is axially movable on its respective upright section 32.

5 Support sections 78, 80 include aligned transverse passages adapted to receive the shank of a screw 86, which has a configuration similar to that of screw 66. The aligned transverse passages in support sections 78, 80 are adapted to be positioned in alignment with one  
10 of indentations 34, and screw 86 is engaged with the passages in support sections 78, 80 so as to selectively fix support 24 in a desired position on upright section 32. The position of support 24 can be adjusted by removing screw 86, repositioning support 24  
15 and replacing screw 86 such that screw 86 engages a different one of indentations 34. A threaded receiver is engaged in the passage in one of the support sections, e.g. section 80, for receiving the threads of screw 86. The central area of the shank of screw 86  
20 may be formed without threads to facilitate engagement with the selected one of indentations 34.

The forward ends of support sections 78, 80 include respective mounting ears 88, 90, which define a space therebetween within which a U-shaped engagement  
25 member 92 having a pair of arms 94 is received. A pivot pin 96 (figures 2,7,8) extends through a passage 98 in engagement member 92 and through aligned openings in ears 88, 90, for pivotably mounting engagement member 92 within the space between ears 88, 90. A foot  
30 100 is pivotably mounted at the end of each engagement arm 94, and preferably includes a soft surface.

Each strap 26 extends through a passage defined by one of supports 24 (see figures 7,8). Each strap 26 has a composite construction, including an inner core  
35 formed of a material that is non-stretchable under

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normal conditions, e.g. a metallic or composite material. The core of strap 26 is over-molded with a hard plastic material which is formed to have a series of one-way teeth 102. Strap 26 includes a hook 104 at its upper end.

The surface of strap 26 opposite teeth 102 is generally smooth, and contacts a curved strap engagement surface 106 defined by support 24 (see figure 8). Strap engagement surface 106 is located between a pair of side walls 108, 109 (figure 6) defined by support sections 78, 80, respectively.

Each support 24 includes a tensioning lever 110 having a handle portion 112 with an elongated opening 113 through which frame upright section 32 extends (figure 8). Tensioning lever 110 is pivotably mounted to support 24 via a pivot pin 114 that extends through a passage 116 formed in the forward end of tensioning lever 110 opposite handle portion 112. Opening 113 is shaped so as to receive frame upright section 32 when tensioning lever 112 is raised and lowered. Tensioning lever 110 includes a cam-shaped forward surface 118 having a series of teeth 120 that face teeth 102 of strap 26. A torsion spring 122 is engaged with tensioning lever 110, for biasing tensioning lever 110 toward a lowered inoperative position in which teeth 120 are disengaged from strap teeth 102.

With reference to figure 8, a strap retainer 124 is pivotably mounted below the forward end of tensioning lever 110 via a pivot pin 126. Strap retainer 124 includes a series of teeth 128 which face the lower end of strap engagement surface 106. A pair of torsion springs 130 (figure 6) engage strap retainer 124 so as to urge teeth 128 toward strap engagement surface 106. Pivot pin 126 also functions to mount a release trigger 132 by engagement within aligned

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openings defined by a pair of arms 134. Each arm 134 includes a recess 136, and strap retainer 124 has outwardly extending tabs 138 that are received within recesses 136. With this arrangement, trigger 132 can  
5 be depressed so as to move teeth 128 out of engagement with strap teeth 102 against the force of torsion springs 130. When trigger 132 is released, torsion springs 130 function to move strap retainer 124 toward strap engagement surface 106 to a position in which  
10 strap retainer teeth 128 engage strap teeth 102, and to move trigger 132 outwardly by engagement of tabs 138 with trigger arms 134.

In operation, equipment carrier 20 is engaged with the trunk or rear door of a vehicle as follows.  
15 Initially, trigger 132 is depressed so as to disengage strap retainer teeth 128 from strap teeth 102, and each strap 26 is extended or moved outwardly relative to its respective support 24 to an extended position. Lower hook 42 of frame 22 is engaged with the lower edge of  
20 the vehicle trunk lid or rear door, and strap hook 104 is engaged with the upper or forward edge of the vehicle trunk lid or rear door (figures 10,11). Supports 24 are positioned on upright members 32 at an appropriate elevation for the trunk lid or rear door to  
25 which equipment carrier 20 is mounted, and engagement member 92 is pivoted so as to bring feet 100 into engagement with the underlying surfaces of the vehicle trunk lid or rear door. Engagement member 92 can be positioned so that feet 100 are in vertical alignment  
30 with each other (figure 10) or such that the upper foot 100 overlies the top surface of the trunk lid and the lower foot 100 engages the rearwardly facing surface of the trunk lid (figure 11). The user then engages screws 86 with supports 24 to maintain supports 24 in  
35 the desired vertical position on frame upright section

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34. Thereafter, the user operates tensioning lever 110 by repeatedly raising and lowering tensioning lever 110. Each time tensioning lever 110 is lifted, teeth 120 of tensioning lever 110 engage strap teeth 102 so as to retract strap 26 until strap hook 104 and lower hook 42 engage the upper and lower edges, respectively, of the trunk or rear door. The user continues to retract strap 26 in this manner so as to induce tension in strap 26 sufficient to maintain strap hook 104 and lower hook 42 in engagement with the upper and lower edges, respectively, of the trunk or rear door. Upon each advancement of strap 26, strap retainer 124 is pivoted away from strap 26 by the passage of strap teeth 102 over strap retainer teeth 128. When tensioning lever 112 is lowered, strap retainer teeth 128 engage strap teeth 102 to prevent strap 26 from being extended, such that tensioning lever 110 and strap retainer 124 function to provide a ratchet-type tensioning mechanism for applying tension to strap 26. In this manner, engagement of hooks 104, 42 with the upper and lower edges, respectively, of the trunk lid or rear door, in combination with engagement of feet 100 therebetween with the surfaces of the trunk lid or rear door, function to securely engage equipment carrier 20 with the trunk lid or rear door.

It is to be noted that the carrier of the invention is able to solve a problem which is encountered when mounting an equipment carrier on a trunk lid as in figure 11, having a substantially horizontal upper surface. In this case, the hooks 104, when engaged on the forward edge of the trunk lid, are substantially at the same level, in the vertical direction, as supports 24. As a consequence of this, the tensioned portions of straps 26 are substantially horizontal or only slightly inclined relative to the

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horizontal. In the absence of the specific structure and arrangement of engagement members 92 as described above, tensioning straps 26 would not cause the lower hooks 42 to be urged upwardly against the lower edge of the trunk lid, so that a safe connection of the carrier to the vehicle would not be achieved. In the invention however, when the straps 26 are tensioned, supports 24 are subjected to a tilting torque around pins 96 (in the direction of arrow T in figure 7) relative to the engagement members 92, which are urged with their pads 100 against the rear and upper surfaces of the trunk lid. As a result of this tilting torque, the lower hooks 42 are safely urged upwardly against the lower edge of the lid.

To remove equipment carrier 20, the user depresses release trigger 132 to disengage each strap retainer 124 from its respective strap 26, which enables straps 26 to be extended and to thereby disengage hooks 104, 42 from the upper and lower edges, respectively, of the trunk lid or rear door.

When equipment carrier 20 is engaged with the vehicle trunk lid or rear door, bicycles or other equipment can be engaged with support arms 28 in a conventional manner using saddles 68 and retainer straps 72. Stabilizers 74 prevent the outer bicycles from swinging, and frame 22 prevents the inner bicycle from swinging.

When equipment carrier 20 is not in use, the user disengages support arms 28 from engagement members 49 and moves support arms 28 inwardly (see figure 9), which allows support arms 28 to be pivoted about cross-member 44 and to hang down between upright sections 32 of frame 22. If desired, support arms 28 can be moved outwardly into engagement with engagement members 49 when positioned in this manner, to maintain support

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arms 28 in position. In addition, screws 86 can be disengaged from the respective indentation 34 in upright section 32, to allow supports 24 to be pivoted toward each other within the space between upright sections 32. This folding capability of supports 24 and  
5 arms 28 allows carrier 20 to assume a compact configuration when not in use, in which it can be stored in a case 150, and to quickly and easily be returned to its normal configuration for use.

10 Straps 26 are manufactured with a length sufficient to enable carrier 20 to be used with any type of vehicle, from one having a small trunk lid, e.g. a small sedan or coupe, to one having a large rear door, e.g. a van or SUV.

15 Frame 22 is configured to have a height sufficient to enable the vehicle license plate to be visible when equipment carrier 20 is mounted to the vehicle. This typically means that, in European countries, frame 22 has a greater height than is necessary for domestic  
20 vehicles, since European vehicles typically have license plates mounted higher than do domestic vehicles.

It should be understood that equipment carrier 20 may be modified to carry other types of equipment, or  
25 to carry similar types of equipment in different ways. For example, frame 22 can be mounted to a vehicle using supports 24 and straps 26, and may include lower support structure for supporting bicycles from below rather than suspending the bicycles from above, i.e. in  
30 a tray-type configuration having either a fork-type mount or a wheel mount. It should also be understood that, while a ratchet-type engagement system is shown for tensioning straps 26, any other type of variable position engagement and tensioning system may be  
35 employed in place of the ratchet-type system.

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Examples of other types of equipment that can supported by carrier 20 include an equipment box 142 (figure 12) which may have a handle 144. In this embodiment, a lower support frame 146 extends rearwardly from lower frame sections 36 and is secured thereto via mounting members 148 and a threaded rod engaged with a knob 150. A single arm 152 extends from upper cross-member 44 of frame 22. A latch 154 is mounted to the end of arm 152, and is engageable with handle 144 of equipment box 142.

In a ski or snowboard carrier version (figure 13), a lower frame 158 extends downwardly from lower frame sections 36 of frame 22. A tray 160 is engaged with lower frame 158, and has compartments configured to receive the lower ends of skis or snowboards. An upper ski/snowboard support 162 is engaged with upper cross-member 44 of frame 22 via a pair of collars 164 having inwardly facing teeth that engage the ridges of engagement members 49. Support 162 includes spaced apart arms between which skis or snowboards are received. Flexible and resilient straps are engaged with the arms and the skis or snowboards so as to maintain the skis or snowboards in position between the arms.

In another version (figure 14), a pair of ski/snowboard supports 168 may be engaged with upright sections 32. Each ski/snowboard support 168 includes spaced apart recesses which are adapted to receive spaced apart areas of skis or snowboards. The ski or snowboard bindings rest on the lower one of ski/snowboard supports 168, and flexible and resilient straps engage the rearward edges of the skis or snowboards to maintain the skis or snowboards in engagement with ski/snowboard supports 168.



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It is understood that various other types of equipment carrying structures may be engaged with the frame so as to carry equipment exteriorly of a vehicle. It is also understood that frame 22 may assume various other configurations and is not limited to the specific type of configuration as shown and described. Frame 22 may have any configuration which provides lateral stability against twisting when engaged with the top and bottom areas of a vehicle trunk lid or door, and which provides intermediate support between the top and bottom engagement of the frame therewith.

With reference to figures 15-26 a second embodiment of the invention is shown therein. In these figures, parts corresponding to those of figures 1-14 are designated by the same reference numerals.

With reference in particular to figures 17, 18, a main difference with respect to the carrier of the first embodiment lies in that each of the two straps 26 is stored in a wound configuration within the body of the respective support 24 when not in use.

With reference to figure 17, engagement member 40 includes a sleeve portion 41 which is freely rotatably mounted around the lower end 38 of the respective upright section 32. A rivet 420 (see figure 27) has its ends secured to two facing circular holes 422, one of which is formed at the top of sleeve portion 41, the other being formed in a tab 423 which is cut and bent away from the front wall of element 40 so as to engage the end portion 38 of the frame tube from below. The rivet is also engaged through two facing slots 421 formed on the upper and lower sides of tube end 38 and elongated in the circumferential direction. Thus, element 40 is able to perform a limited rotation around the axis of end portion 38, as well as a limited rotation around an axis orthogonal to the axis of the

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end portion 38 and substantially coincident with the axis of rivet 420. Due to these features, each hook 42 is able to perform slight rotations both around the axis of end portion 38 and an axis orthogonal thereto, in order to better engage the lower edge of the trunk lid or door, whatever is the configuration and orientation of this edge.

Still with reference to figure 17, contrary to the first embodiment, the upright section 32 is not provided with the forwardly facing spaced indentations 34 which have been shown in figure 1. In the case of the second embodiment each upright section 32 has only a forwardly facing flat wall 32a (see also figure 19). Each support 24 has a frame 300 which is formed by a U-bent metal sheet having a central portion 300a engaged around the respective section 32 and two parallel walls 300b which extend forwardly with respect to the section 32 from the central portion 300a (see figures 15, 18 and 20). Each side wall of the frame 300 has a cut-away portion 300c adjacent to the central portion 300a (see figures 15, 19). The two cut-away portions 300c can be tightened around section 32 in a clamp-like fashion by a screw 302 (figure 19) having a head 304 engaging one of the two portions 300c and screwed at the other end into a nut 306 associated to the other portion 300c. By loosening screw 304, the frame 300 of support 24 (figure 15) is free to slide along section 32 and can then be clamped at any desired position by tightening again screw 302. The two side walls 300b of frame 300 have outwardly deformed portions defining two bosses 308 (figure 19) having facing holes 310 around which a tubular roller 312 is freely rotatably mounted. The roller 312 is for winding the strap 26 within the body of support 24. To this end, one end of the strap 26 which is opposite to hook 104 is secured by two screws

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314 to roller 312. As visible in figure 18, the strap 26 has no teeth formed thereon, contrary to the first embodiment described in the foregoing. In the case of the second embodiment, the strap 26 is preferably made of steel and coated with one of more layers of synthetic material.

With reference to figures 18-21, two ratchet wheels 316, with one-way teeth 317, are secured on the two ends of roller 312 projecting outwardly from the side walls of frame 300.

As in the case of the first embodiment, a tensioning lever 110 is pivotably mounted to support 24 around the axis 318 of roller 312. As visible in figure 20, the body of tensioning lever 110 is defined by two half-shells 320. Also in this case the body of the tensioning lever 110 has an opening 113 shaped so as to receive the frame upright section 32 when tensioning lever 110 is raised and lowered by acting on the handle portion 112 of the lever 110. The pivotal mounting of lever 110 around axis 318 is obtained by means of two hub-like portions 322 of half-shells 320 which are rotatably mounted around the end portions of roller 312. Moreover, the half-shells 320 define a passage 324 (figure 20) for engagement of a screw (not shown) adjacent to the handle portion 112.

An engagement pawl 326 (figure 21) cooperates with each ratchet wheel 316. Each pawl 326 is pivotably mounted by a pin 328 on a respective hub-portion 322 of the body of the tensioning lever 110. A spring 330 is interposed between each pawl 326 and a wall of the hub-portion 322 in order to bias pawl 326 into engagement on the teeth 317 of ratchet wheel 316. Moreover, a retainer 332 cooperates with each ratchet wheel 316. Both retainers 332 are pivotally mounted by a common pin 334 to frame 300 of support 24. Each retainer 332

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has teeth 336 engaging the teeth 317 of the respective ratchet wheel 316. The two retainers 332 are rigidly connected to the structure of a trigger member 338 (figure 18) which is thus swingable along with retainers 332 around the axis of common pin 334 with respect to the support frame 300. A spring 339 (having a shape similar to spring 122 of the first embodiment) is interposed between frame 300 and trigger member 338 in order to bias trigger member 338 into a rest position in which retainers 332 are engaged with the teeth of ratchet wheels 316.

The operation of the above described ratchet mechanism is as follows:

Supposing that the strap 26 is stored in the wound condition within support 24, the user must first of all grasp the end portion of the strap 26 carrying the hook 104 and pull the strap in order to unwind it from support 24 and bring hook 104 into engagement on the upper front edge of the vehicle door or trunk lid. As in the first embodiment, hook 104 is engaged on the upper edge of the trunk lid or door after lower hooks 42 have been engaged on the lower edge.

Unwinding of the strap 26 from the respective support 24 is accomplished when trigger member 338 is pressed. In order to do that, the user grasps the upright section 32 from behind at the level of support 24 and pulls trigger member 338 rearwardly by one or more fingers of his hand. By holding the trigger member 338 in the pulled condition, the retainers 332 (figure 21) are held in a disengaged condition with respect to the teeth of ratchet wheels 316. Moreover, with the tensioning lever 110 being in the lower position shown in figure 21, each pawl 326 is in the position shown in the same figure, close to retainer 332. Therefore, when retainers 332 are held in a condition spaced from the

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teeth 317 of wheel 316 by acting on trigger member 338, each pawl 326 is pushed by the respective retainer 332 to a position disengaged from teeth 317. In this condition the user is able to grasp the free end of strap 26 and pull it up to the desired length, causing unwinding of the strap from support 24. Rotation of wheels 316 during unwinding does not have any influence on lever 110, since the pawls 326 carried by lever 110 are disengaged from wheels 316 by the action of trigger member 338. Once the hook 104 has been engaged on the upper edge of the trunk lid or door, the trigger member 338 can be released, so that each retainer 332 and each pawl 326 return to the condition shown in figure 21. After that, the strap 26 can be tensioned by repeated raising and lowering movements of the tensioning lever 110. Each time that the lever 110 is raised (by a clockwise rotation with reference to figure 21) pins 328 and pawls 326 follow the lever in its rotation, so that the each pawl 326 moves away from the associated retainer 332 and causes rotation of the cooperating ratchet wheel 316. As visible in figure 18, the clockwise rotation of wheels 316 is transmitted to roller 312 thus causing winding of the strap 26 within support 24. During this rotation, the common pin 334 remains at its fixed position relative to support 24, and retainers 332 along with trigger member 338 repeatedly swing around pin 334 as a result of the movement of teeth 317 with respect to retainers 332.

When the tensioning lever 110 is returned to its lower position, retainers 332 hold the cooperating wheels 316 in their previously reached position, whereas the two pawls 326 return to the position shown in figure 20 adjacent to retainers 332. During their return movement, the pawls 326 repeatedly swing around their respective pins 328 due to their movement with

- 21 -

respect to the teeth 317 of wheels 316. By repeating the upward and downward movement of the tensioning lever 313 a sufficient number of times, the strap 26 can be tensioned as desired.

5       The trigger member 338 of each support 24 can be locked in its rested position by a key-operable lock 400 which acts on a lock member 402 (shown in figure 18). The lock member 402 can be moved between the horizontal position shown in figure 18 and a vertical position. In the horizontal position, the lock member 402 prevents actuation of the trigger member 338 by coming in contact against section 32. When the locking member 402 is moved to its vertical position, trigger member 338 can be actuated.

15       When the user wants to remove the carrier from the vehicle, he must actuate trigger member 338 in order to move retainers 332 to the raised position in which retainers 332 disengage pawls 326 from wheels 316. In this condition the strap 26 can be pulled a sufficient length in order to disengage hook 104 from the upper edge of the trunk lid or door. When this has been done, trigger member 338 can be released and the tensioning lever 110 can be repeatedly actuated in order to wind the strap 26 completely within the respective support 24.

Figures 25, 26 are views similar to those of figures 10, 11, showing the carrier according to the second embodiment mounted on a station wagon having a rear door and a sedan car having a trunk lid.

30       Again, also in this case, the arrangement of the engagement members 92 pivoted to supports 24 and carrying the swivel pads 100 causes the lower hooks 42 to be urged upwardly when the straps are tensioned even when the carrier is mounted on a trunk lid having a substantially horizontal upper surface, as in figure 35

26. As already discussed with reference to the first embodiment, this result is due to the tilting action around the axis of pivot pins 96 to which the frame of the carrier is subjected upon tensioning the straps.

5        Figure 16 shows the second embodiment in the form adapted for carrying skis, similarly to what has been shown in figure 14 with reference to the first embodiment.

10        Naturally, while the principle of the invention remains the same, details of the embodiments may widely vary with respect to what has been illustrated purely by way of example.

15        For instance, supports 24 hosting the strap winding means could be separated from further supports to which engagement members 92 could be mounted. Moreover, the means for tensioning the straps could be in form of a ratchet mechanism of a type different from that described herein by way of example, or it could be also in form of any other mechanism, different from a ratchet mechanism. Also the member for controlling tensioning of the strap could be different from a swingable lever such as lever 110. For example, this member could be in form of a rotating handle or knob.

20        Furthermore, also the second embodiment can be arranged in order to transport the various items of equipment which have been shown with reference to the first embodiment, as well as also many other different items.

25        It is also understood that frame 22 may assume various other configurations and is not limited to the specific type of configuration as shown and described.

30        Figure 28 of the drawings shows an arrangement of the carrier in which it is provided with an additional foot member 800 on each upright section of the frame, which can rest on the vehicle rear bumper to reduce the  
35

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load applied to the lower edge of the rear door or lid, which may be advantageous particularly in cases where the carrier is used to transport relatively heavy items.



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**WHAT IS CLAIMED IS:**

1. An equipment carrier for mounting onto a rear component of a vehicle structure, such as a vehicle trunk lid or door, comprising:

- a frame having lower engagement means engageable with a lower area of the vehicle component;
- a structure connected to the frame or forming part thereof, for carrying one or more items of equipment;
- at least one vehicle engaging member, connected to the frame or forming part thereof, for engaging the vehicle component at a position above said lower area,
- a strap member having upper engagement means for engagement with an upper area of the vehicle component,
- at least one support connected to the frame or forming part thereof, provided with strap engaging and tensioning means, which are engaged by said strap member and can be controlled for tensioning the strap member in order to tighten said upper and lower engagement means onto said upper and lower areas of the vehicle component.

2. A carrier as set forth in claim 1, wherein said strap engaging and tensioning means comprise a mechanism for holding the strap member in any set position relative to said support, a strap tensioning member for applying tension to said strap member, and a release control member for releasing said mechanism in order to enable free movement of the strap member relative to said support.

3. A carrier as set forth in claim 2, wherein said mechanism is a ratchet mechanism.

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4. A carrier as set forth in claim 1, wherein said vehicle engaging member for engaging the vehicle component is mounted to said support.

5        5. An equipment carrier for mounting onto a rear component of a vehicle structure, such as a vehicle trunk lid or door, comprising:

- a frame having lower engagement means engageable with a lower area of the vehicle component;
- 10        - a structure connected to the frame or forming part thereof, for carrying one or more items of equipment;
- at least one vehicle engaging member, connected to the frame or forming part thereof, for engaging the
- 15        vehicle component at a position above said lower area,
- a strap member having upper engagement means for engagement with an upper area of the vehicle component,
- at least one support connected to the frame or forming part thereof, provided with strap engaging
- 20        means, which are permanently engaged by said strap member and are also adapted for storing the strap member within said support in a wound or folded configuration.

25        6. A carrier as set forth in claim 5, wherein said strap engaging means are in form of strap winding means.

30        7. A carrier as set forth in claim 6, wherein the strap winding means comprise a mechanism for holding the strap winding means in any set condition, a strap tensioning member for controlling the mechanism in order to apply a tension to the strap member, and a release control member to release the mechanism in

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order to enable unwinding of the strap member from said strap winding means.

8. A carrier as set forth in claim 7, wherein said  
5 mechanism is a ratchet mechanism.

9. A carrier as set forth in claim 5, wherein said vehicle engaging member for engaging the vehicle component is mounted to said support.

10

10. An equipment carrier for mounting onto a rear component of a vehicle structure, such as a vehicle trunk lid or door, comprising:

- 15 - a frame having lower engagement means engageable with a lower area of the vehicle component;
- a structure connected to the frame or forming part thereof, for carrying one or more items of equipment;
- 20 - at least one vehicle engaging member, connected to the frame or forming part thereof, for engaging the vehicle component at a position above said lower area,
- a strap member engaged with a support on said frame and having upper engagement means for engagement with an upper area of the vehicle component,
- 25 - wherein the vehicle engaging member is pivotally mounted with respect to the frame around a pivot axis, so that when the carrier is mounted on the vehicle, tensioning the strap member induces a tilting action on said frame around said pivot axis which causes the
- 30 lower engagement means of said frame to be urged against the lower area of the vehicle component.

11. A carrier as set forth in claim 10, wherein said vehicle engaging member is in form of a rocking  
35 member having a mid portion pivotally supported around

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said pivot axis by said frame and two end portions to which vehicle engaging feet are pivotally connected.

12. A carrier as set forth in claim 11, wherein  
5 said rocking member is U-shaped.

13. A carrier as set forth in any of claims  
1,5,10, wherein said frame includes a pair of upright  
sections, a cross-member which interconnects the upper  
10 ends of said upright sections and is provided with  
means for mounting the equipment-carrying structure,  
curved lower sections extending from the lower ends of  
the upright sections, and terminating in forwardly  
facing ends, and a hook carrying member mounted to each  
15 of said forwardly facing ends and including a hook.

13. A carrier as set forth in claim 12, wherein  
each hook carrying member is mounted on the associated  
forwardly facing end of said frame so as to be able to  
20 perform a limited rotation with respect to said  
forwardly facing end.

14. A carrier as set forth in claim 12, wherein  
said support is mounted on a respective one of said  
25 upright sections by connecting means enabling an  
adjustment of the position of said support along said  
upright section.

15. A carrier as set forth in claim 14, wherein  
30 each upright section has forwardly facing spaced  
indentations selectively engageable by said connecting  
means.

16. A carrier as set forth in claim 14, wherein  
35 said connecting means are in form of clamp means

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carried by said support and adapted to be tightened around said upright section at any position thereof by means of a screw.

5        17. A carrier as set forth in claim 16, wherein each upright section has a forwardly facing flat surface engageable by said tightening screw of said clamp means in order to prevent rotation of the support relative to the upright section.

10        18. A carrier as set forth in claim 16, wherein said support has a supporting structure in form of a U-bent metal sheet surrounding a rearwardly facing portion of the upright section and having two cut-away  
15 portions defining said clamp means, which are engageable by said tightening screw forwardly of said upright section.

20        19. A carrier as set forth in claim 13, wherein said means for mounting the equipment-carrying structure which are provided on said cross-member comprise an array of angularly spaced axial ridges arranged around the cross-member and extending  
25 longitudinally therealong and at least one equipment carrying arm having a hub section with an inner surface having an array of longitudinal angularly spaced teeth which are engageable with said ridges, to connect said arm to said cross-member at different desired  
orientations.

30        20. A carrier as set forth in claim 19, wherein said ridges are formed on an engagement member surrounding said cross-member.

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21. A carrier as set forth in claim 20, wherein said engagement member surrounding the cross-member has a split construction.

5        22. A carrier as set forth in claim 19, wherein said hub section has a split construction.

10        23. A carrier as set forth in claim 3, wherein said support has a through passage through which said strap member is engaged, said strap member having a series of one-way teeth, and wherein said ratchet mechanism includes a toothed strap retainer pivotally mounted to said support and elastically biased to a position in which its teeth engage the teeth of the  
15        strap member, so as to enable movement of the strap member in a tensioning direction and preventing movement of the strap member in the opposite direction.

20        24. A carrier as set forth in claim 23, wherein said strap tensioning member is in form of a lever pivotally mounted on said support and having a series of one-way teeth engageable with said teeth of the strap member, said lever being operable to have an active movement from a first position to a second  
25        position, where it causes tensioning of the strap member, and an inactive return movement from the second position to the first position, during which the strap retainer holds the strap member in the previously reached position.

30

25. A carrier as set forth in claim 24, wherein said release control member is in form of a trigger member which can be actuated in order to move said strap retainer away from its position engaging the  
35        strap member.

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26. A carrier as set forth in claim 23, wherein said support has a split construction.

5        27. A carrier as set forth in claim 8, wherein said strap winding means include a strap winding roller rotatably mounted to said support, on which the strap member can be wound, and wherein said ratchet mechanism includes at least one ratchet wheel carried by said  
10 winding roller and having a series of one-way teeth, and a retainer pivotally mounted to said support and elastically biased to a position in which its teeth engage the teeth of the ratchet wheel, so as to enable a rotation of the wheel in a strap winding tensioning  
15 direction and preventing an opposite rotation of the wheel.

28. A carrier as set forth in claim 27, wherein said strap tensioning member is in form of a lever  
20 pivotally mounted on said support and provided with a toothed pawl pivotally connected to the structure of said tensioning lever and elastically biased to a position in which it engages the teeth of the ratchet wheel, said lever being operable to have an active  
25 movement from a first position to a second position, where said pawl causes rotation of the ratchet wheel in the strap winding direction, and an inactive return movement from the second position to the first position, during which the retainer holds the ratchet  
30 wheel in the previously reached position.

29. A carrier as set forth in claim 28, wherein said release control member is in form of a trigger member which can be actuated in order to move said

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retainer away from its position engaging the ratchet wheel.

30. A carrier as set forth in claim 24 or 28,  
5 wherein said support is mounted on an upright section forming part of the carrier frame, and wherein said tensioning lever is pivotally mounted to said support around an axis located forwardly of said upright section, and has a body extending rearwardly of the  
10 upright section, with a through passage through which the upright section is arranged.

31. A carrier as set forth in claim 30, wherein said release control member is in form of a trigger  
15 member arranged on said support forwardly of the upright section and operable by pulling it rearwardly.

32. An equipment carrier arrangement for mounting onto a rear component of a vehicle structure, such as a  
20 vehicle trunk lid or door, comprising:

- a frame having lower engagement means engageable with a lower area of the vehicle component;
- a structure connected to the frame or forming part thereof, for carrying one or more items of  
25 equipment;
- at least one vehicle engaging member, connected to the frame or forming part thereof, for engaging the vehicle component at a position above said lower area,
- a strap member having upper engagement means for  
30 engagement with an upper area of the vehicle component,
- at least one support connected to the frame or forming part thereof, provided with strap engaging means which are permanently engaged by said strap member, so that said strap member constitutes an  
35 integral part of said carrier arrangement, whereby the



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latter can be mounted on a vehicle with no need of additional separate strap members.

33. A carrier as set forth in claim 19, wherein  
5 said equipment carrying structure is selected among a number of different structures adapted to carry different items of equipment, such as bicycles, skis, snowboards, pieces of luggage.

FIG. 1

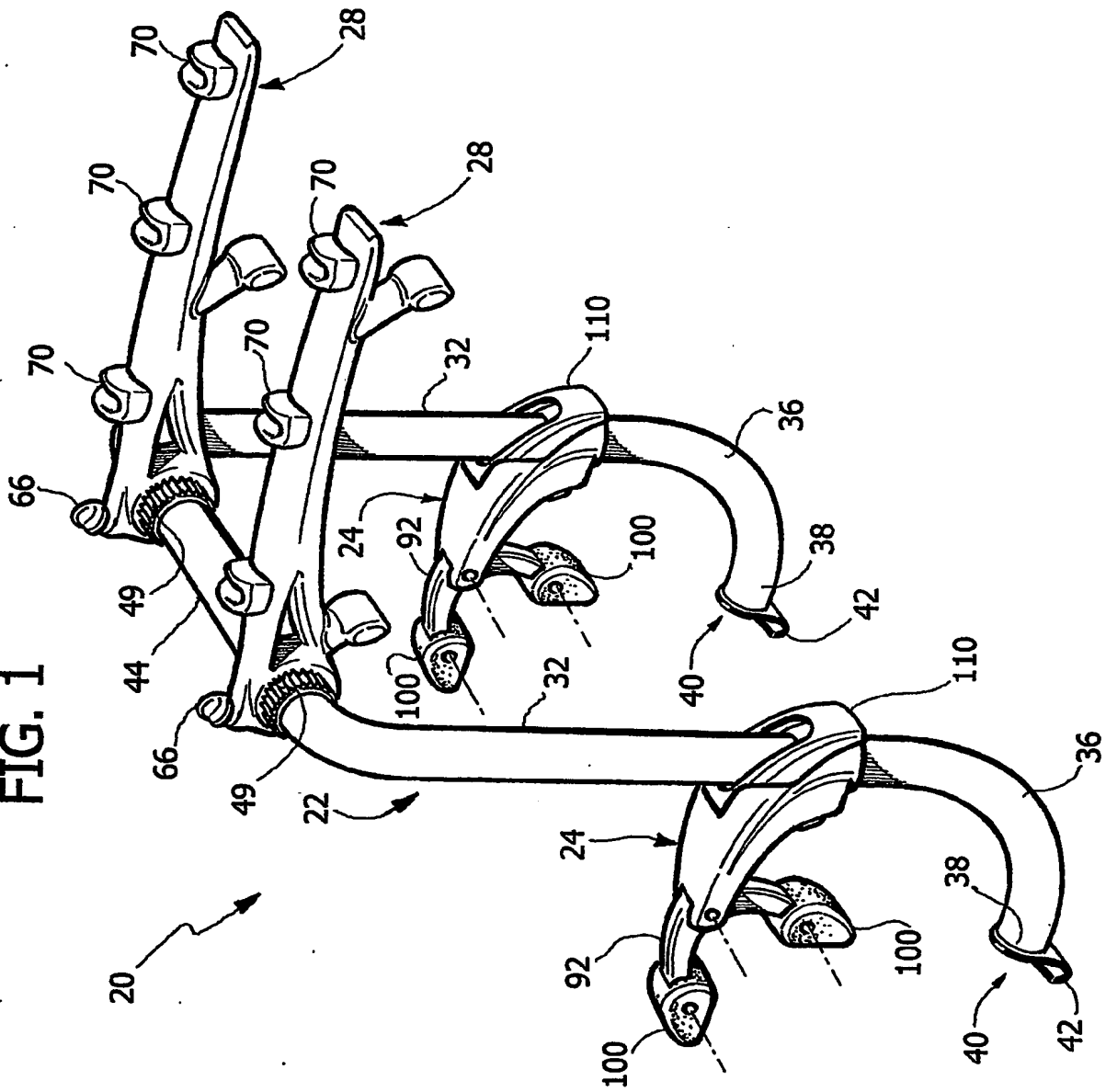


FIG. 2

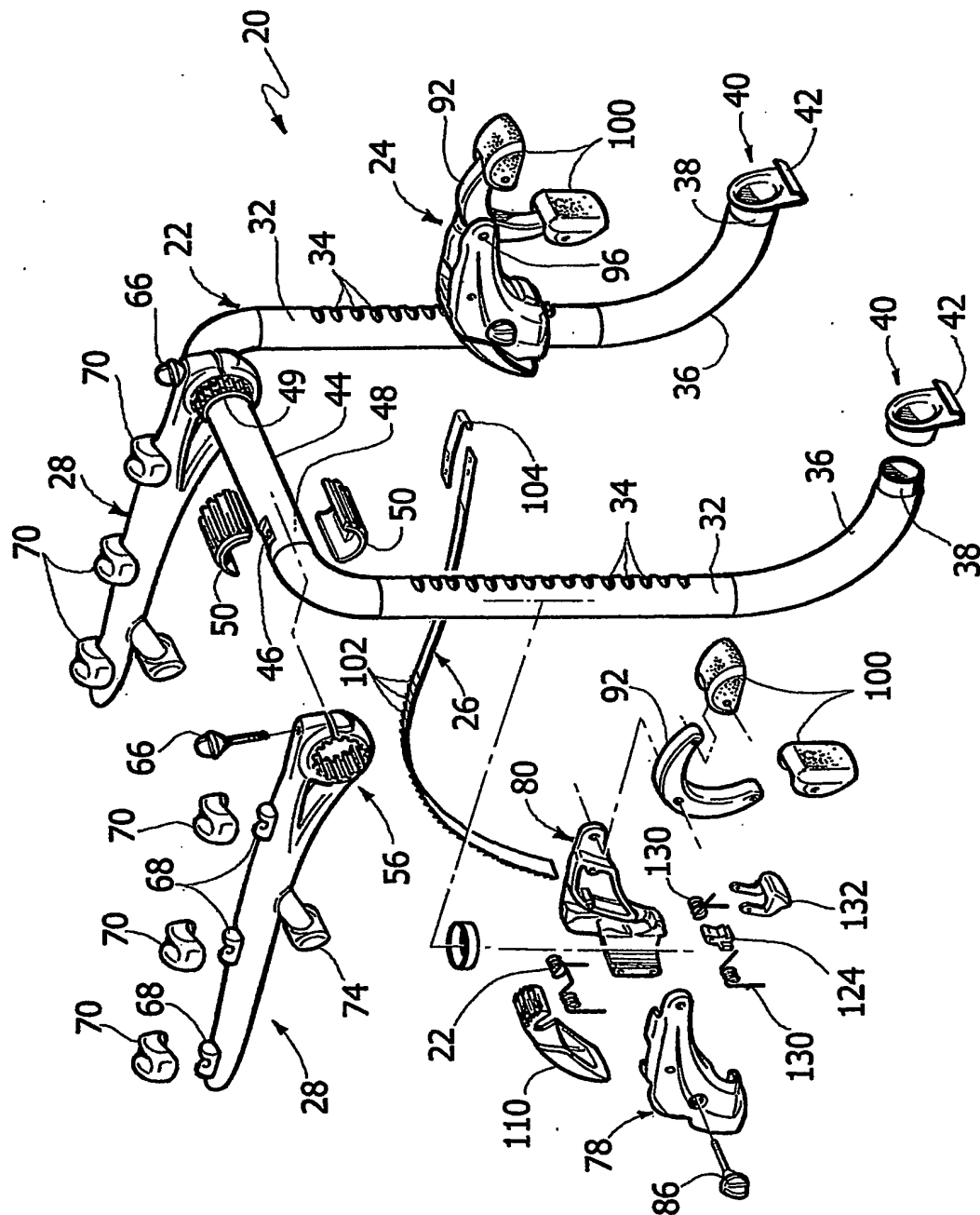


FIG. 3

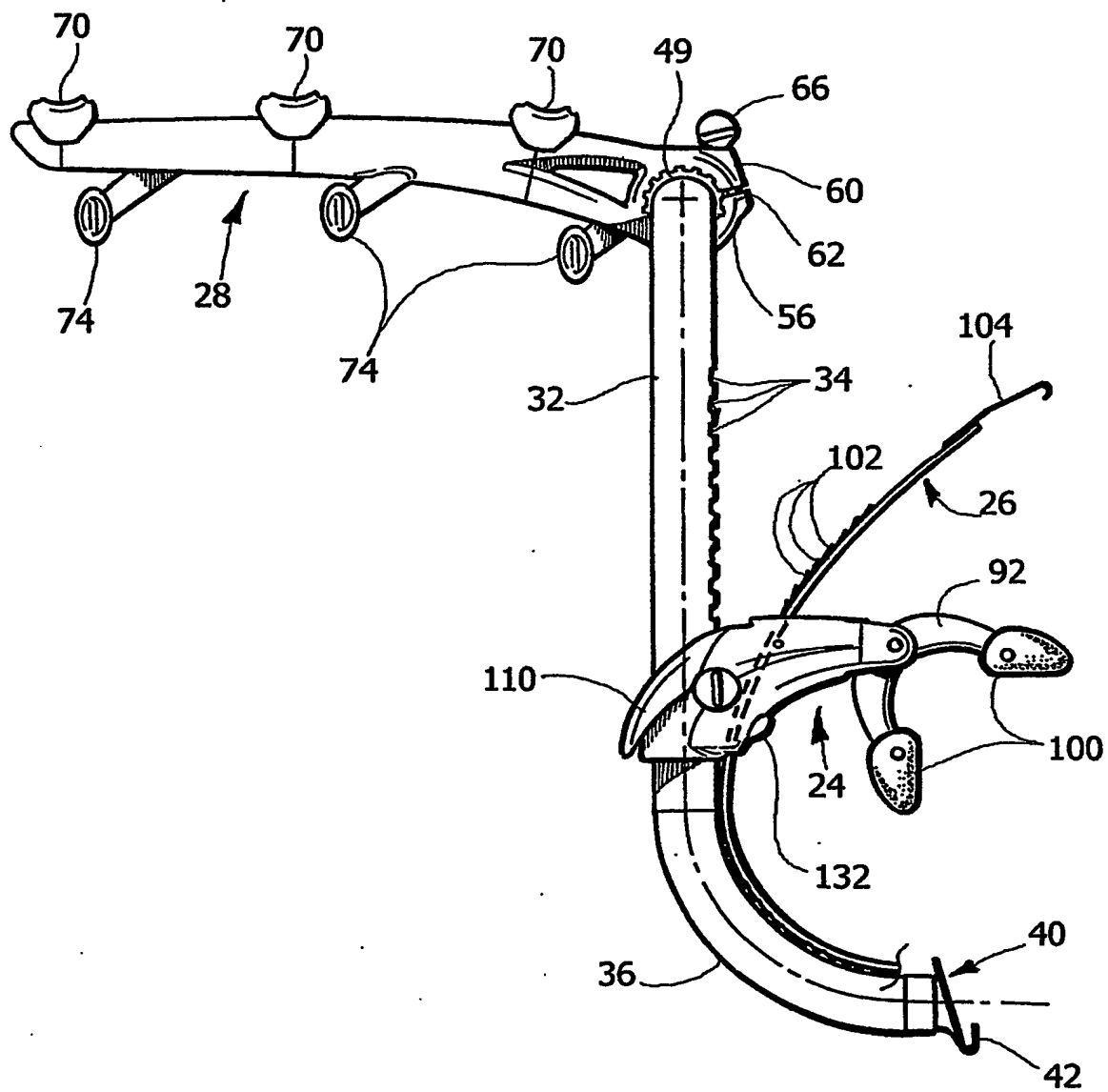


FIG. 4

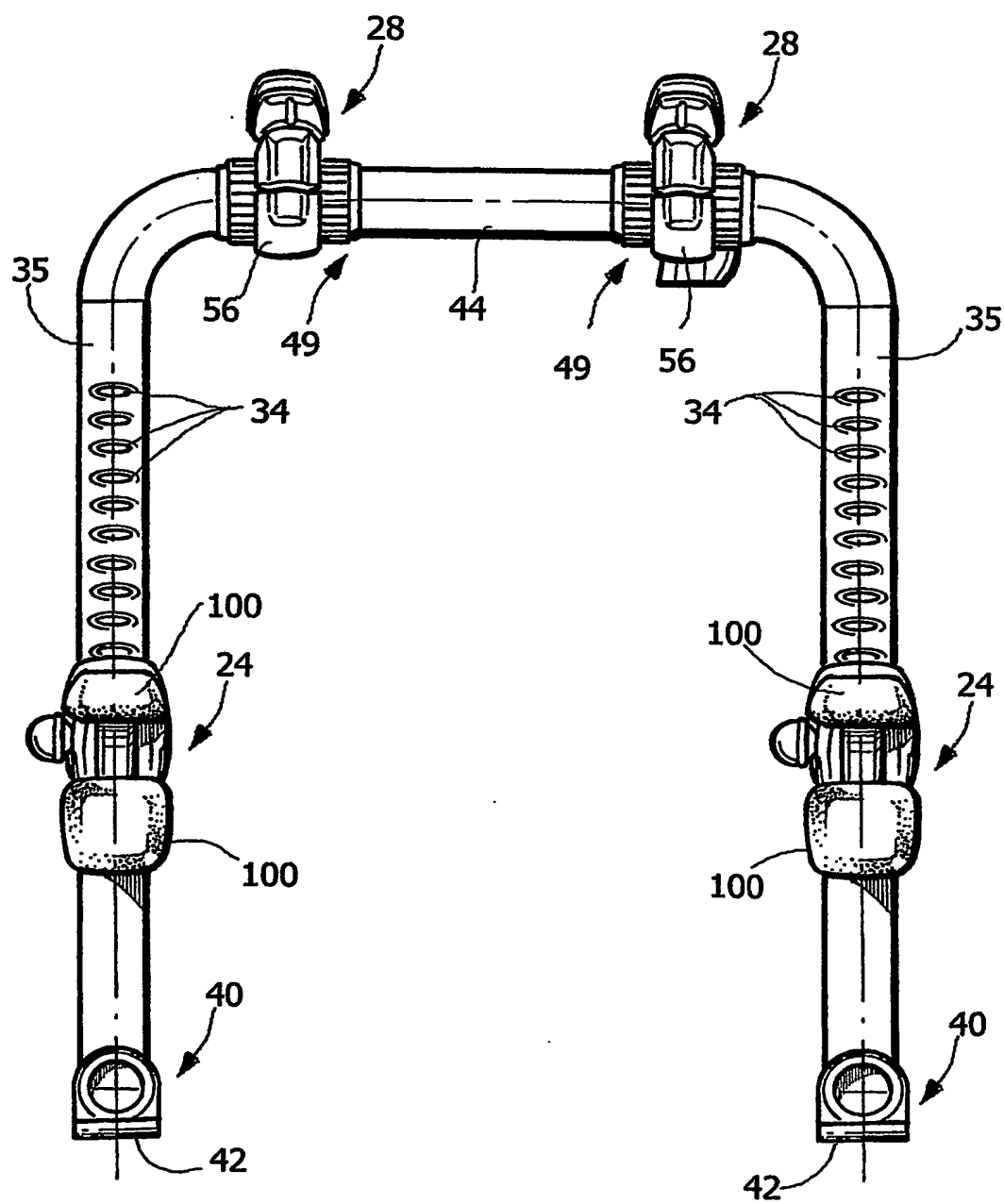


FIG. 5

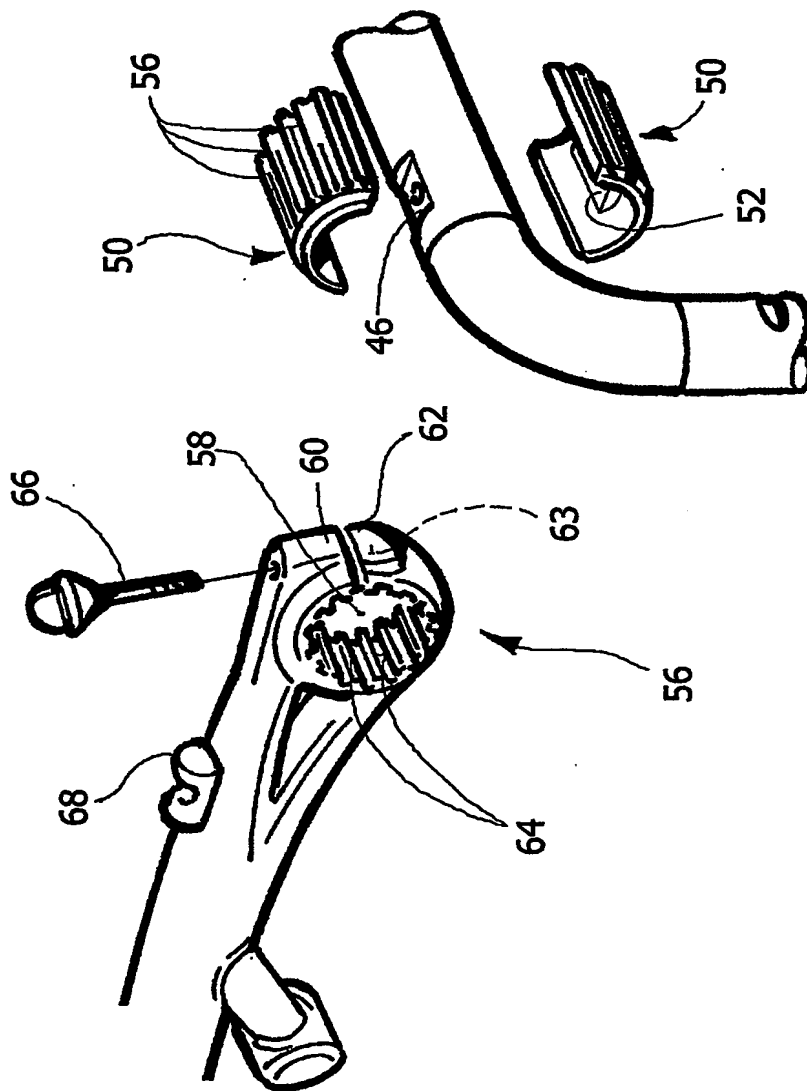


FIG. 6

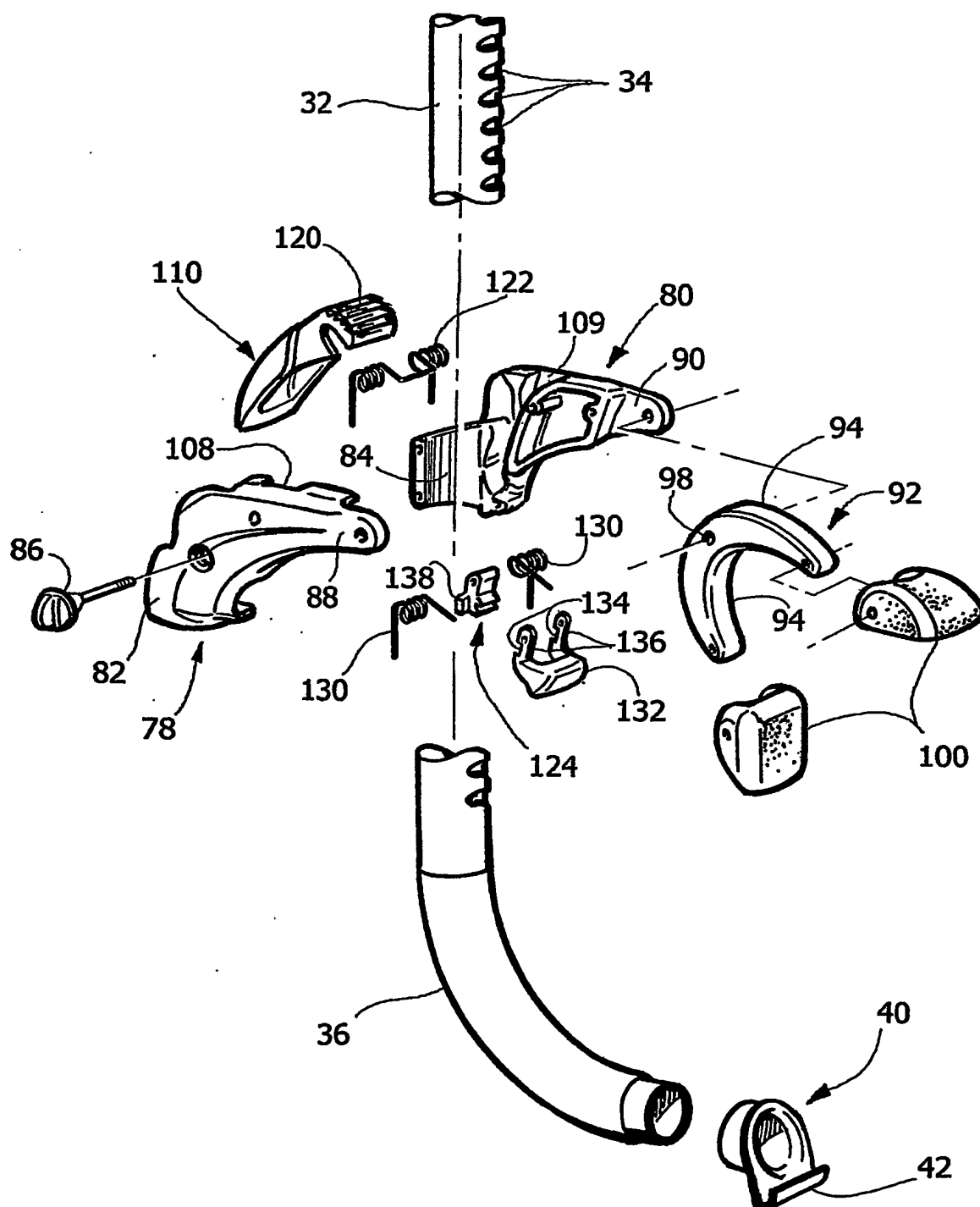


FIG. 7

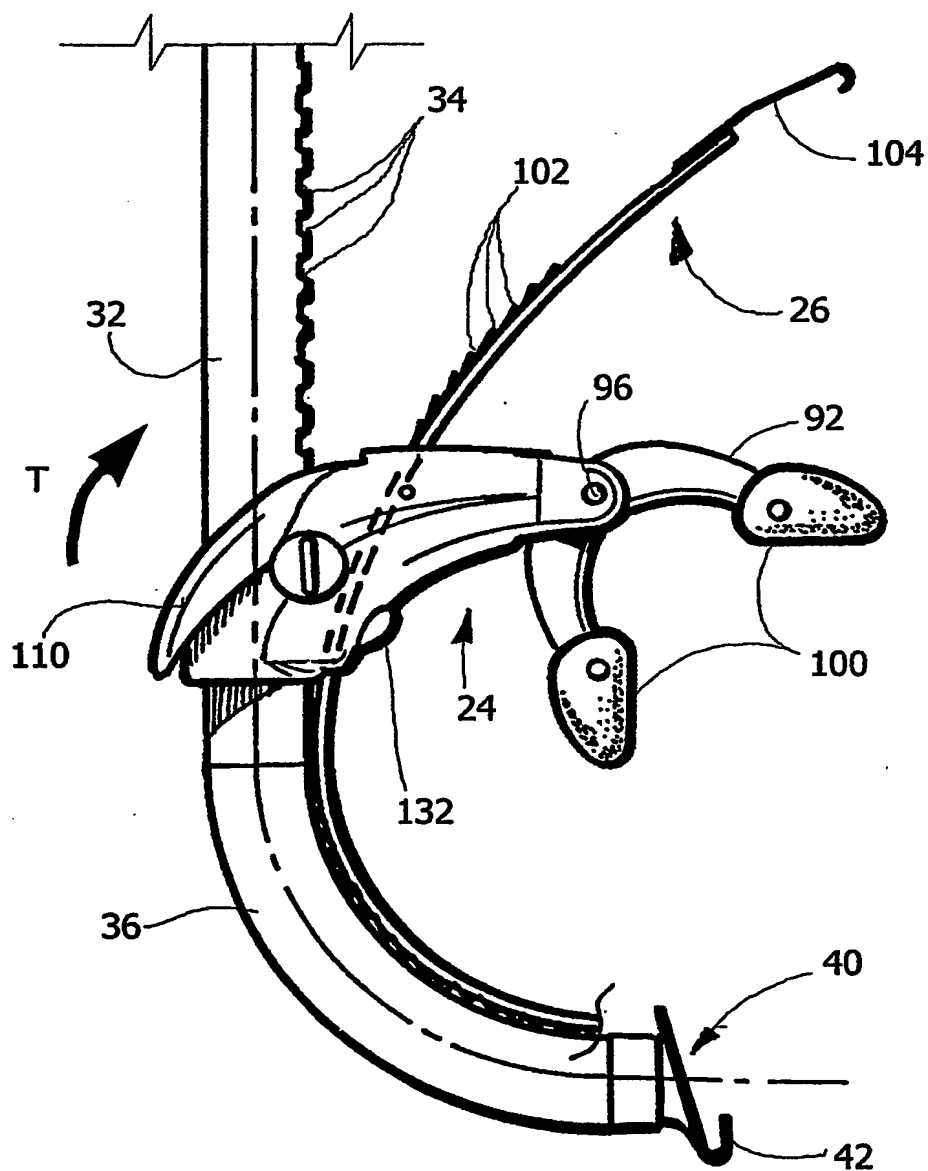




FIG. 8

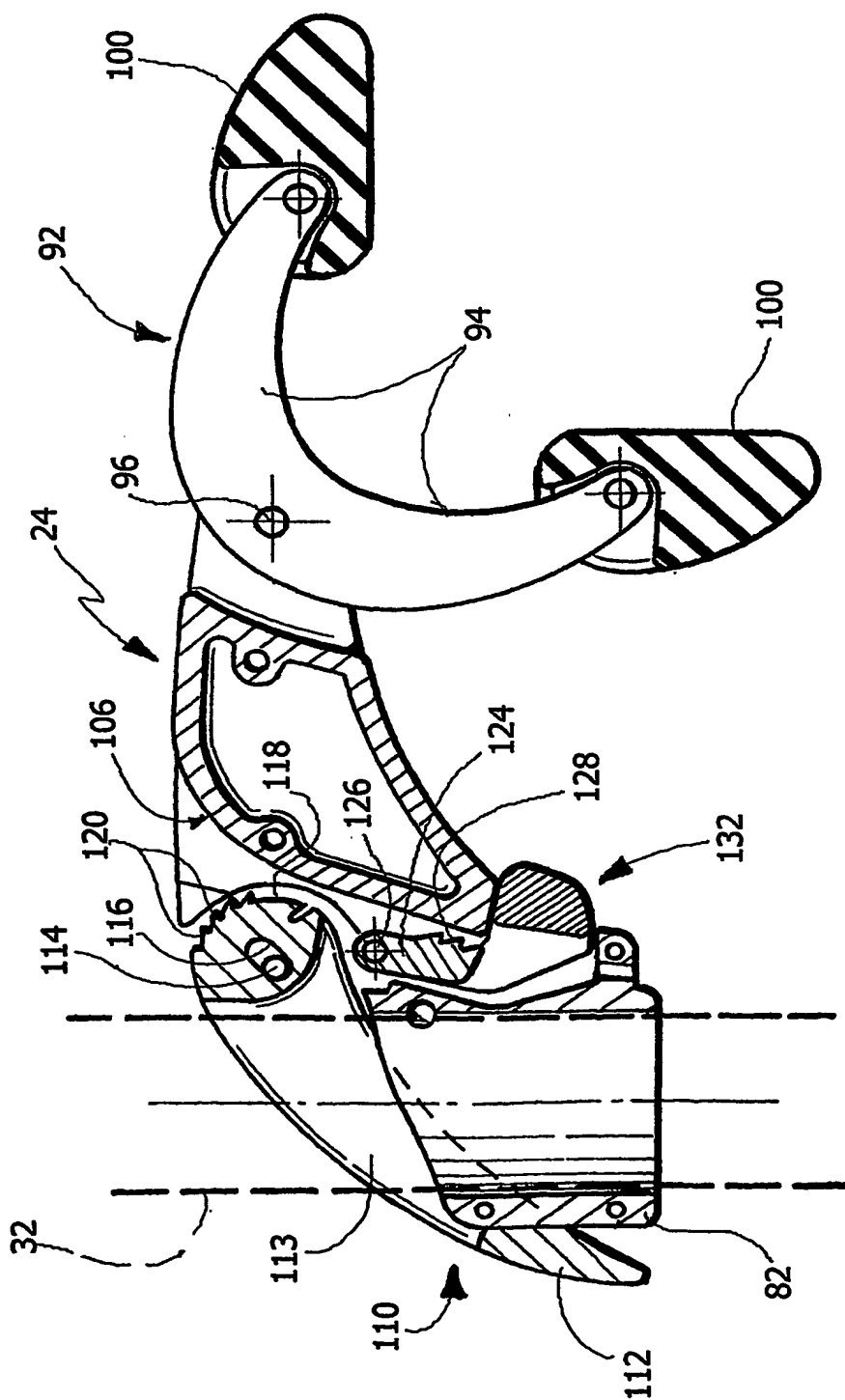


FIG. 9

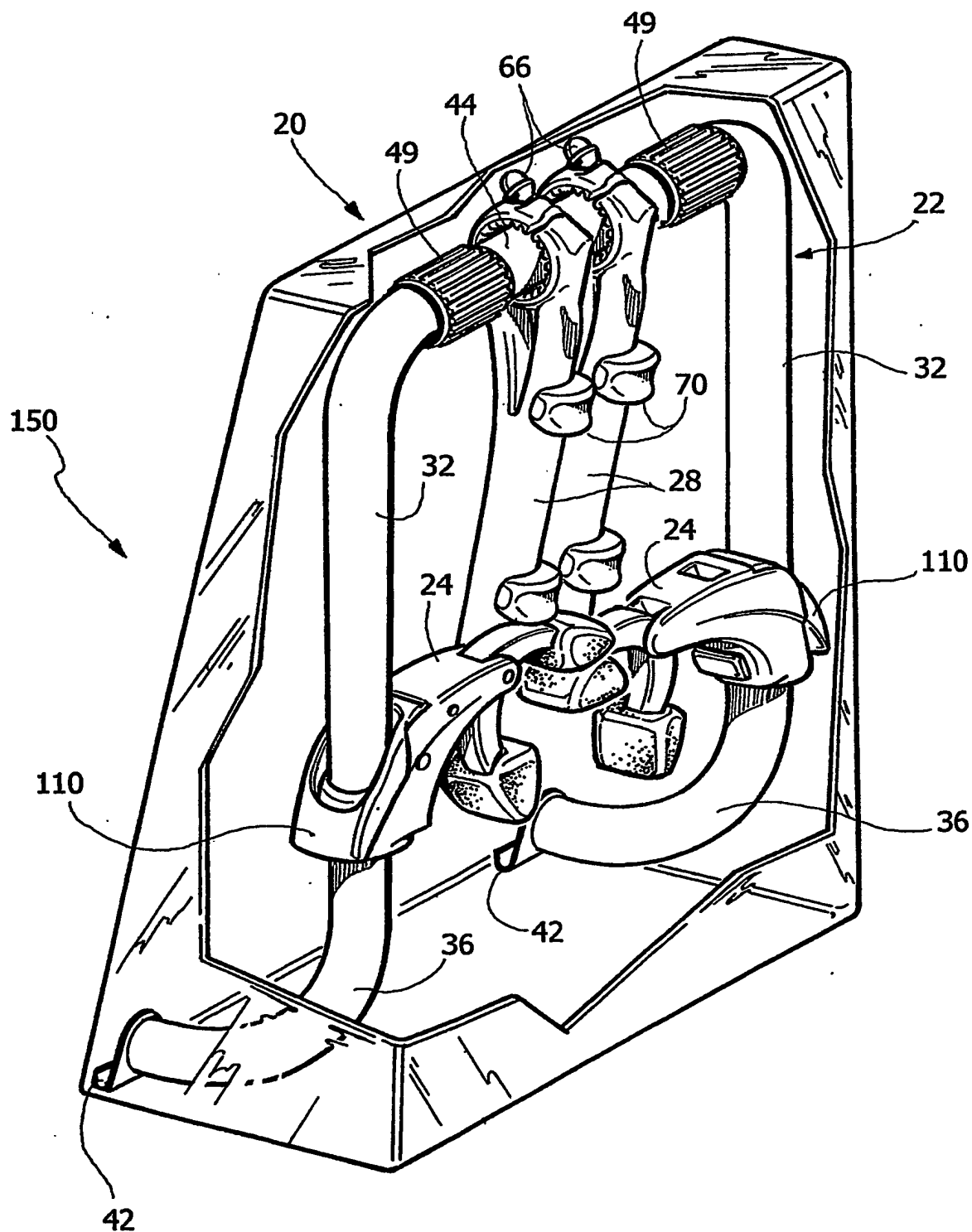


FIG.10

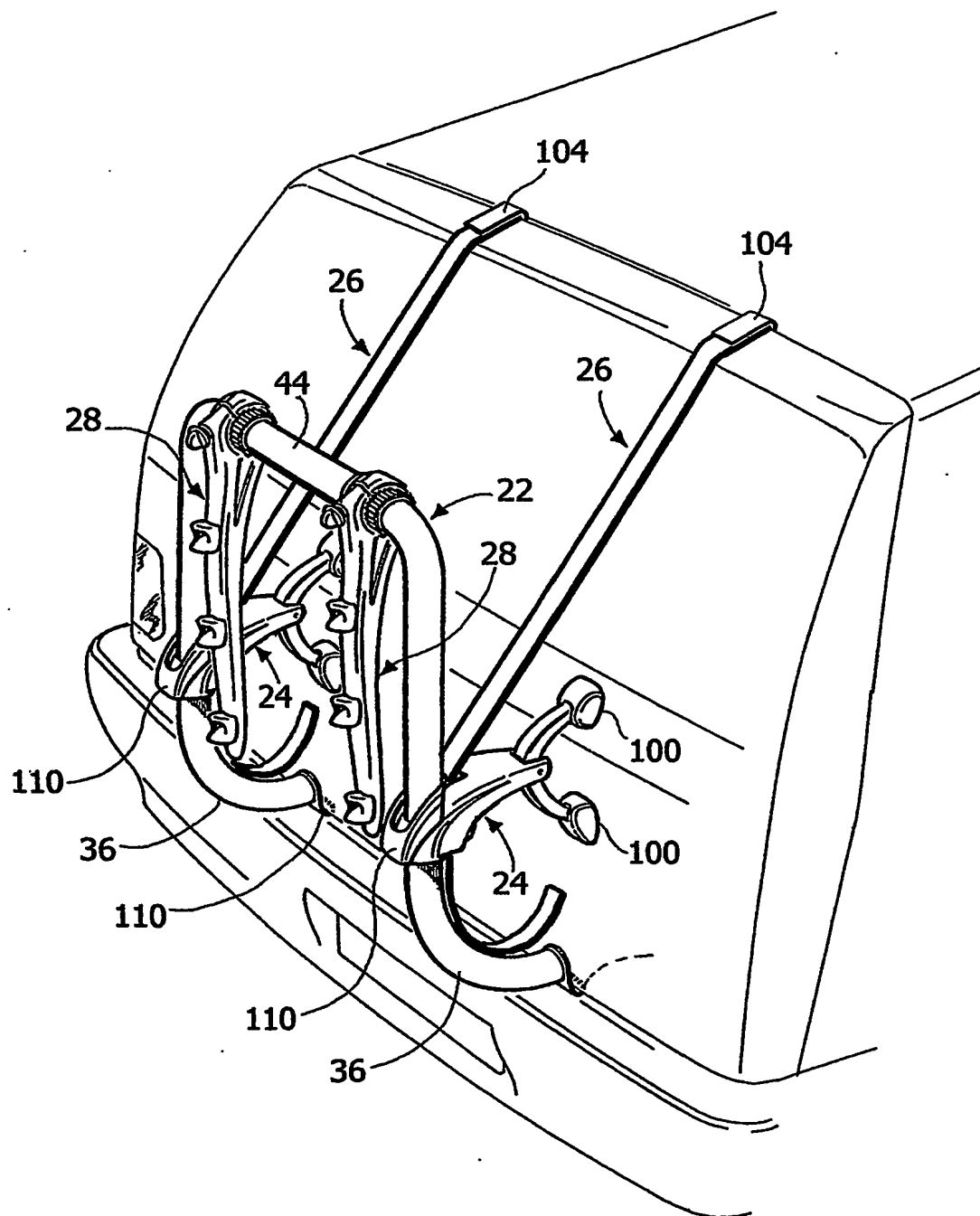


FIG. 11

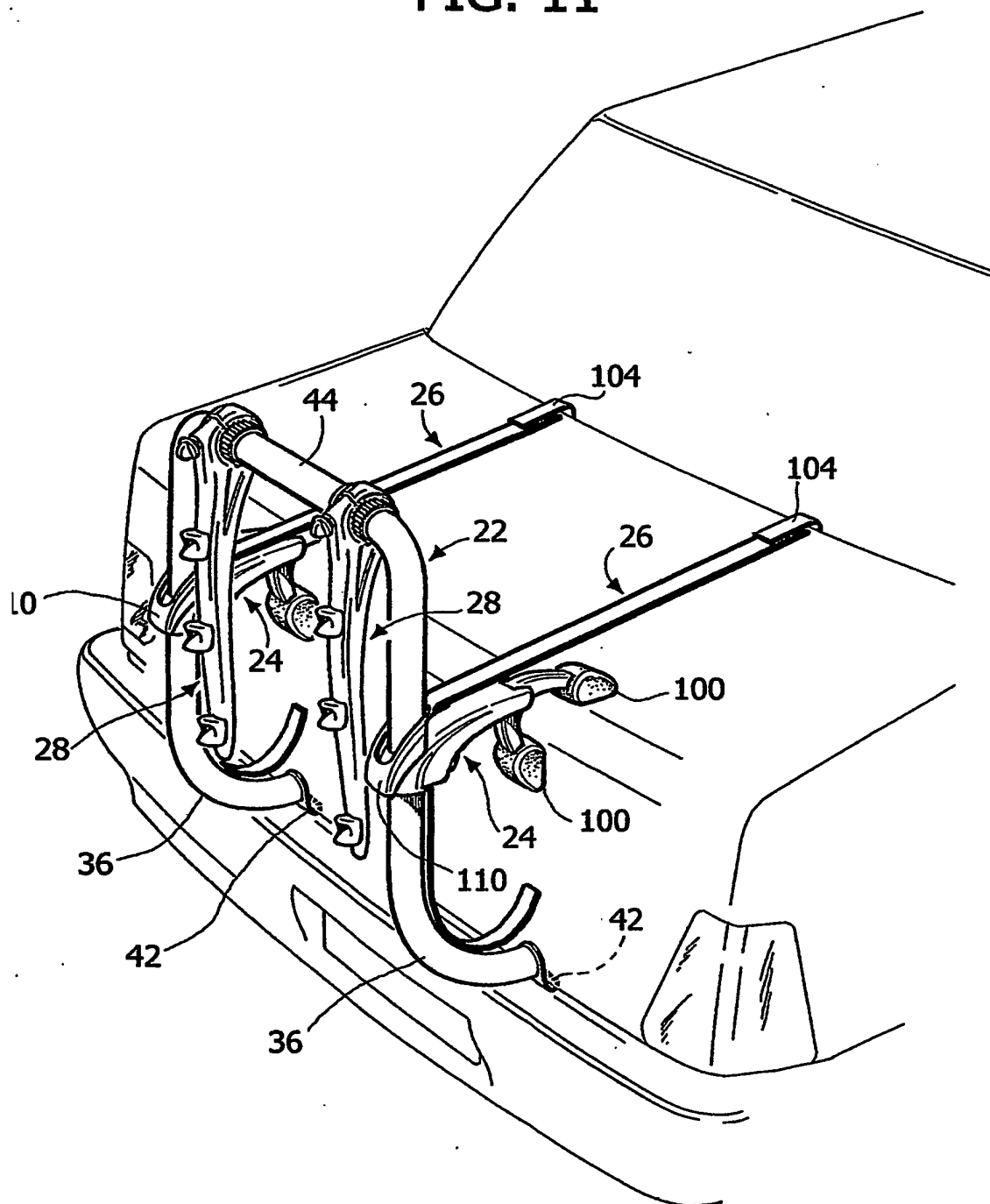


FIG. 12

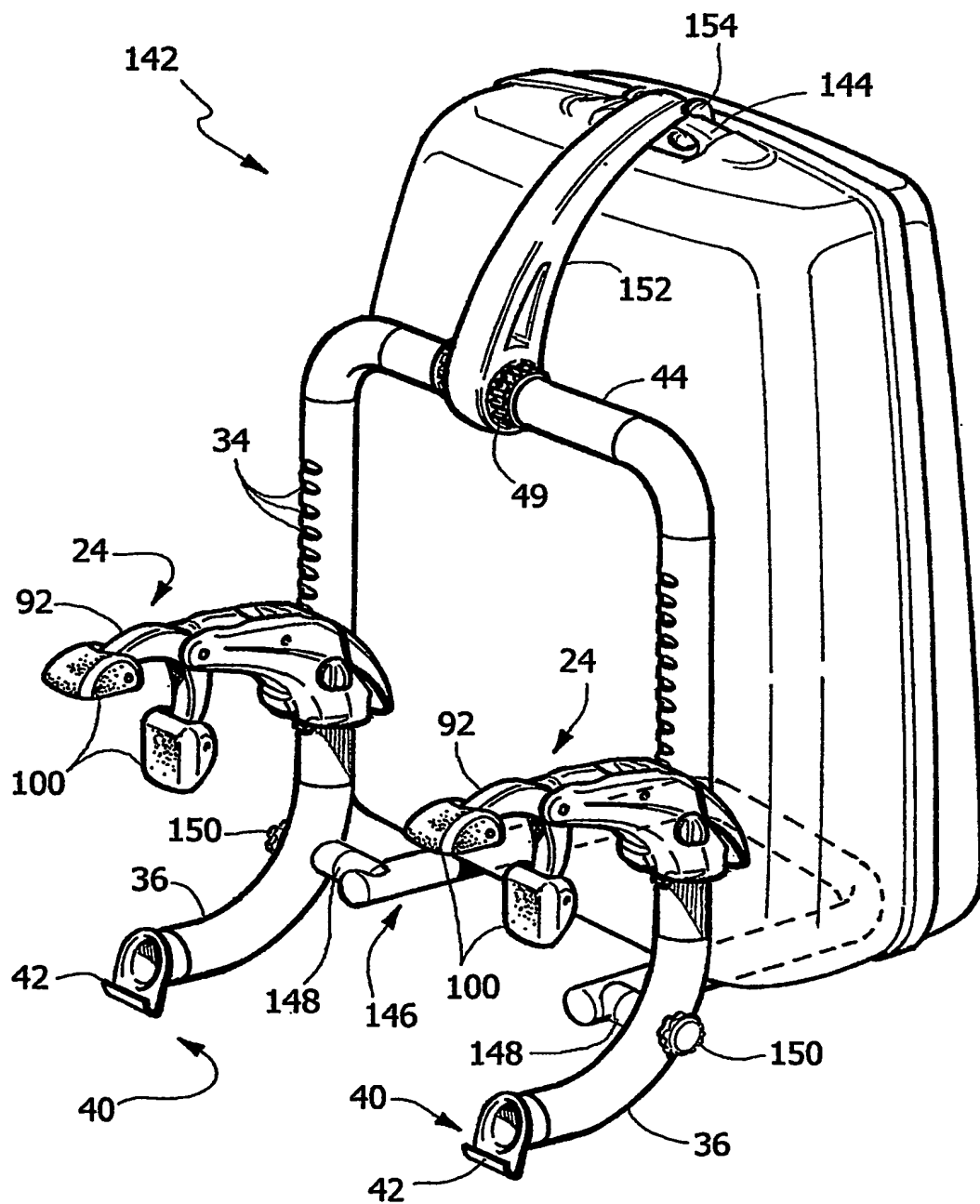


FIG.13

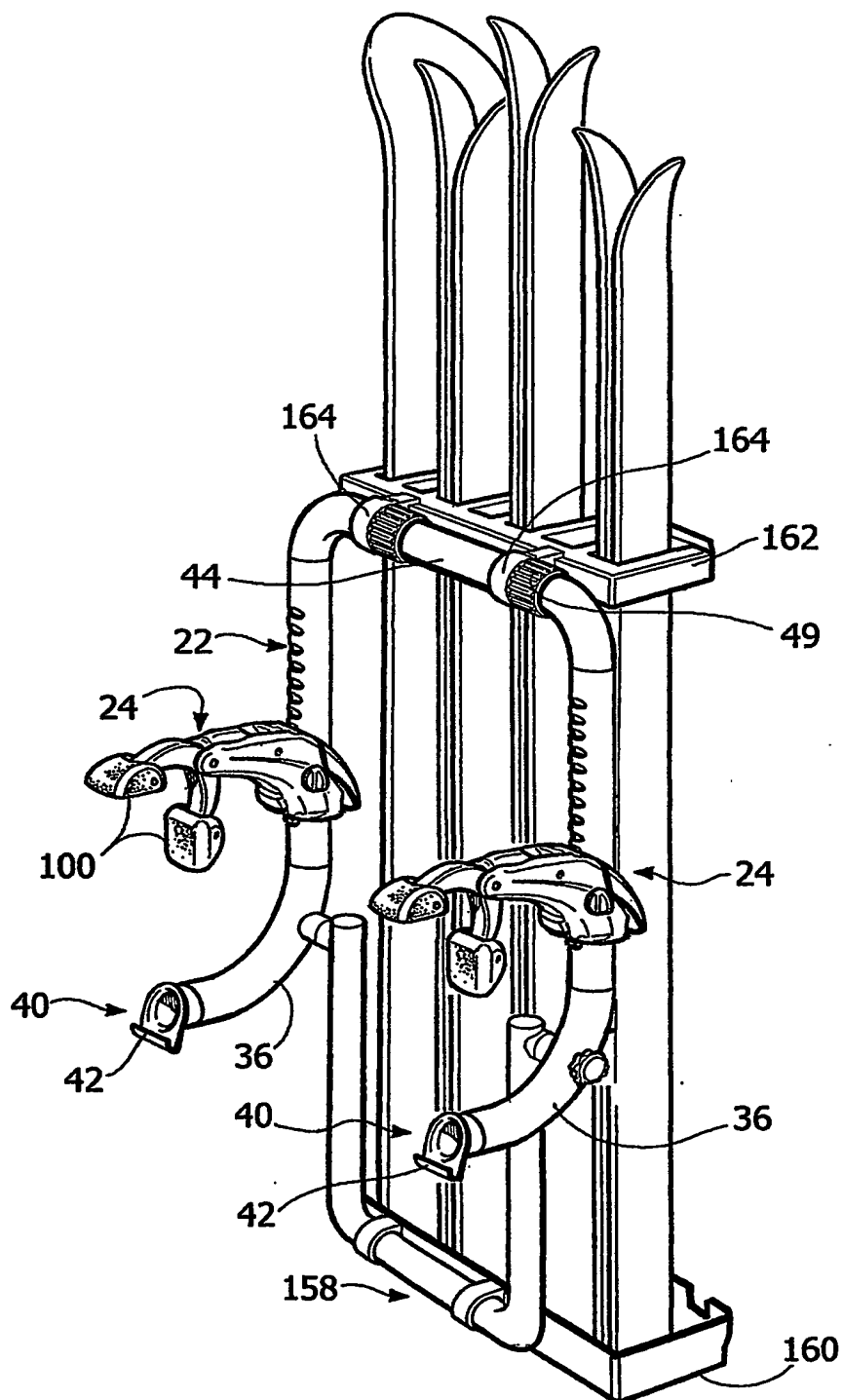


FIG. 14

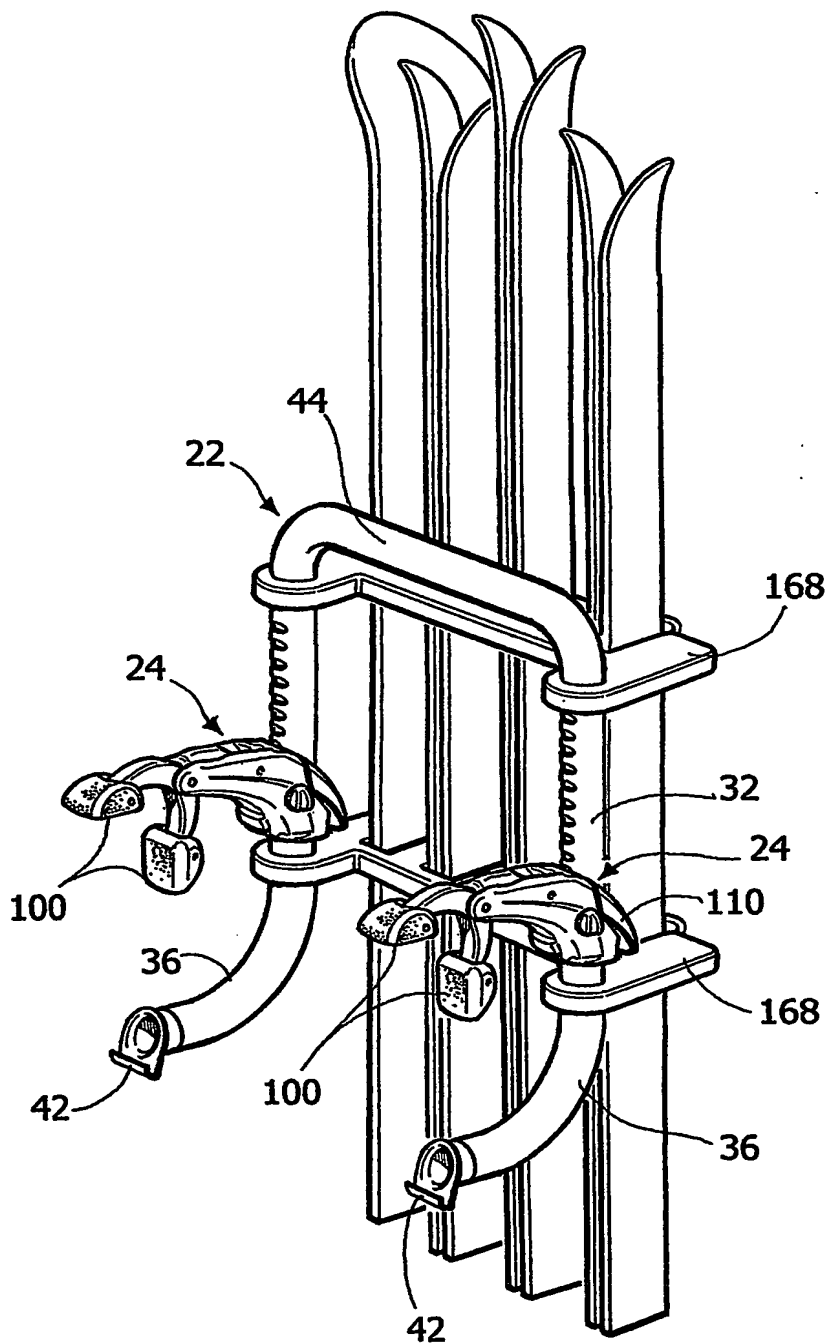


FIG.15

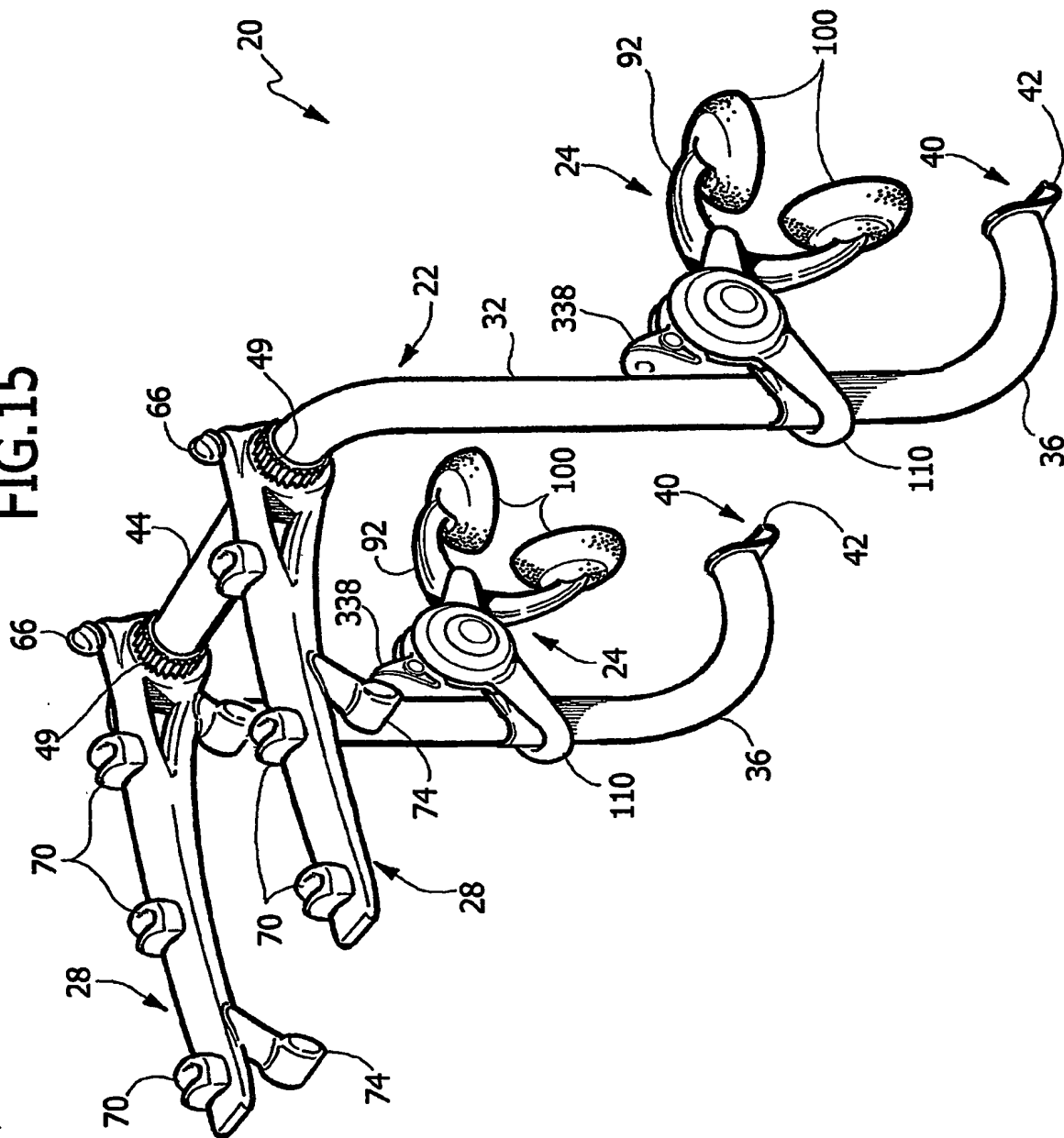




FIG. 16

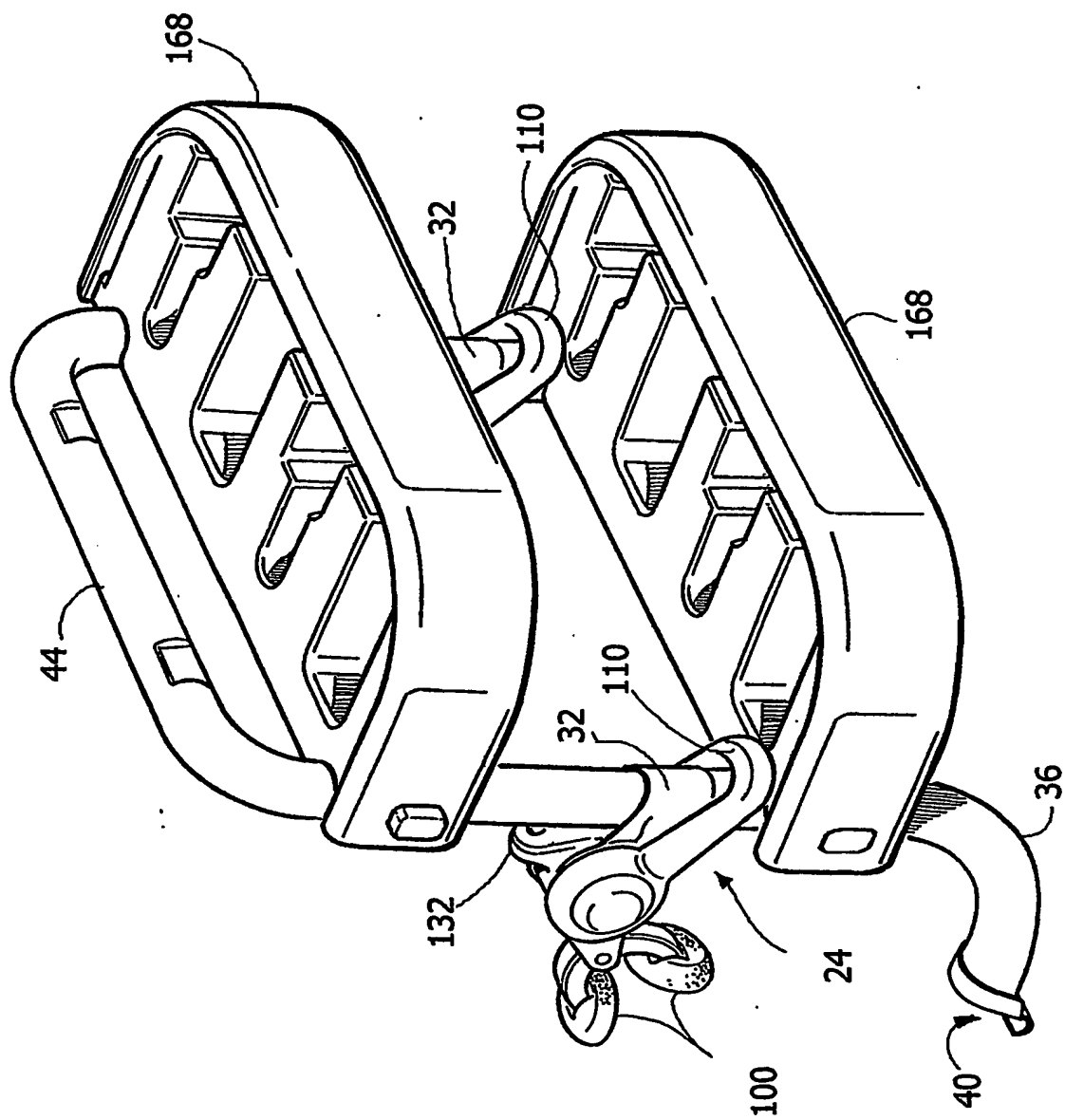


FIG. 17

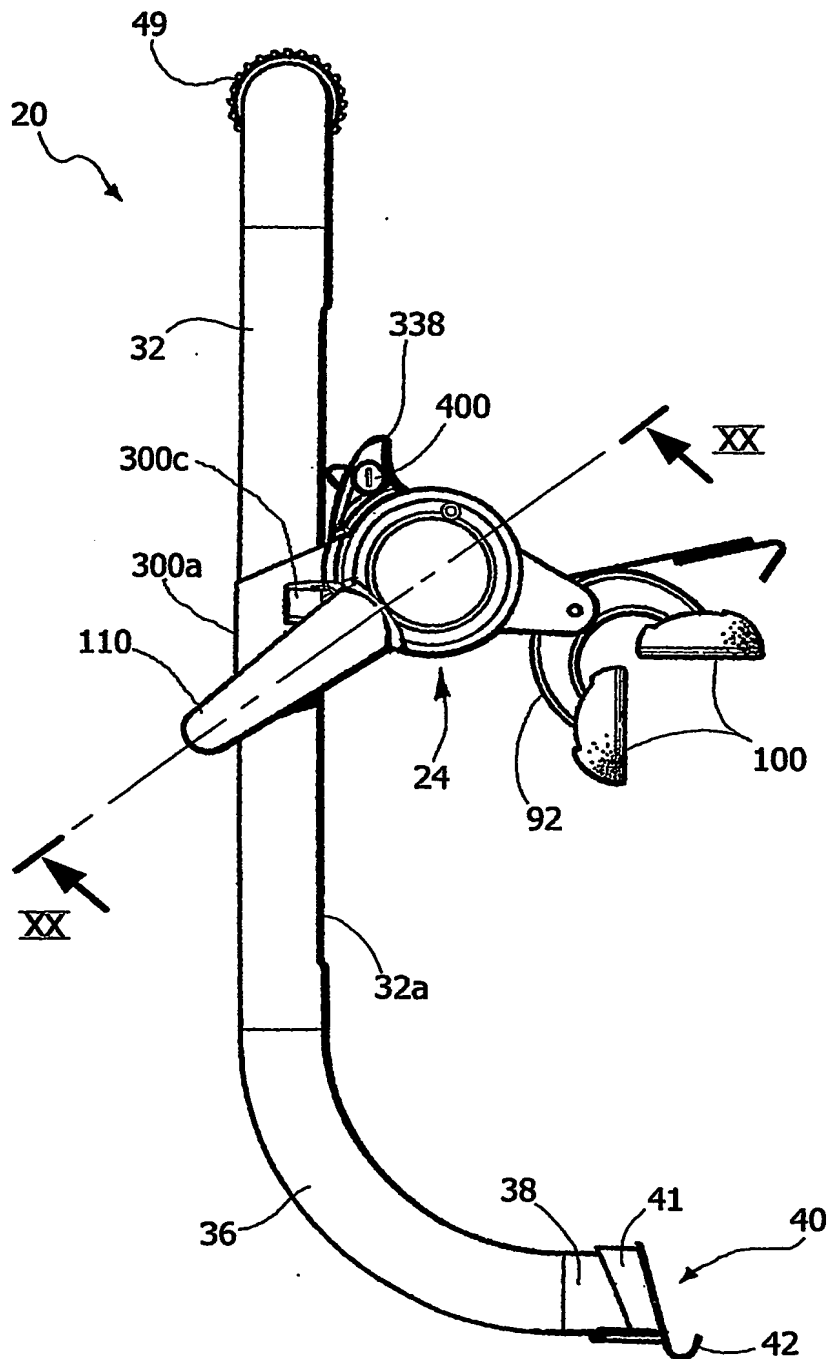


FIG. 18

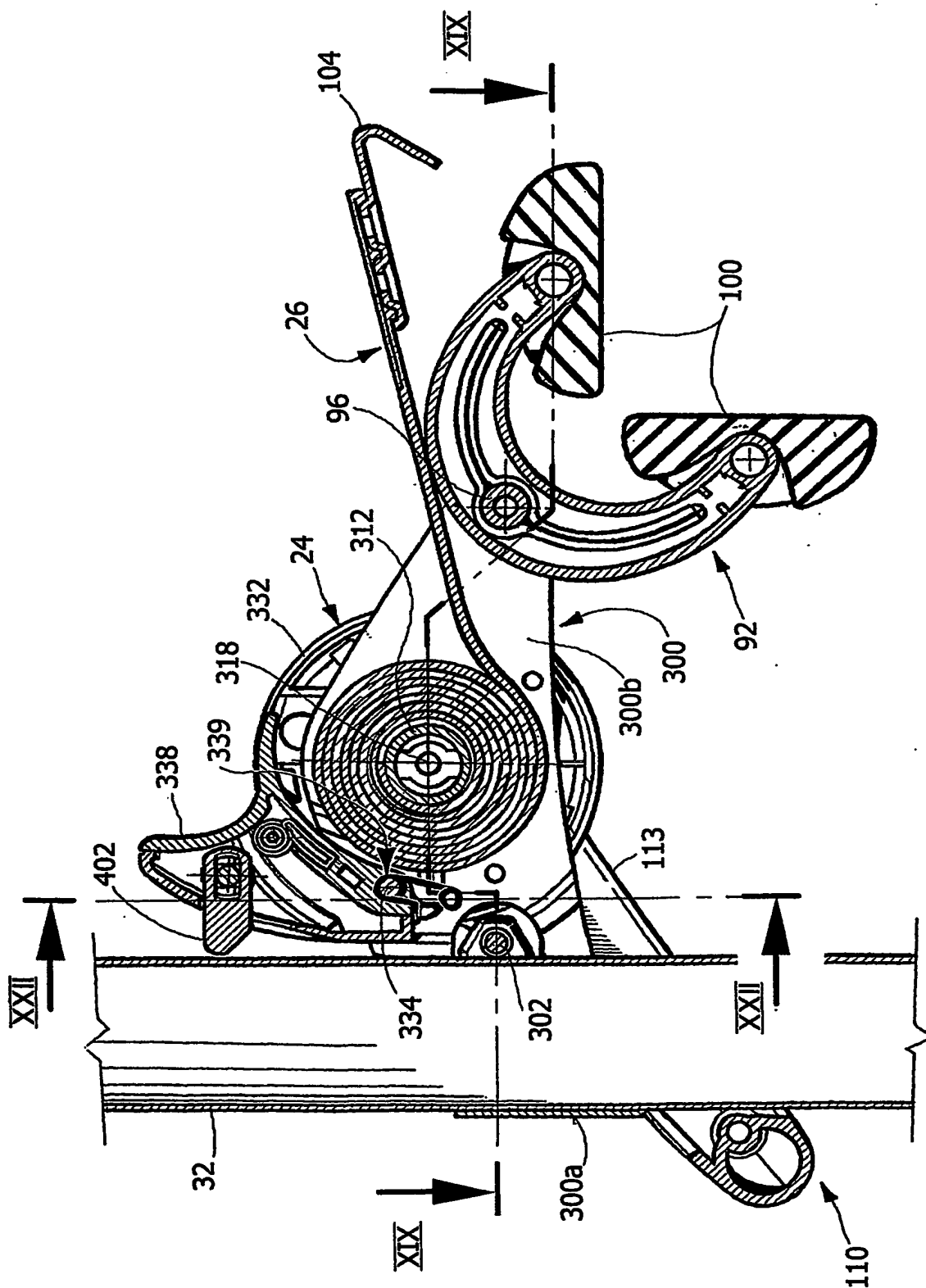


FIG. 19

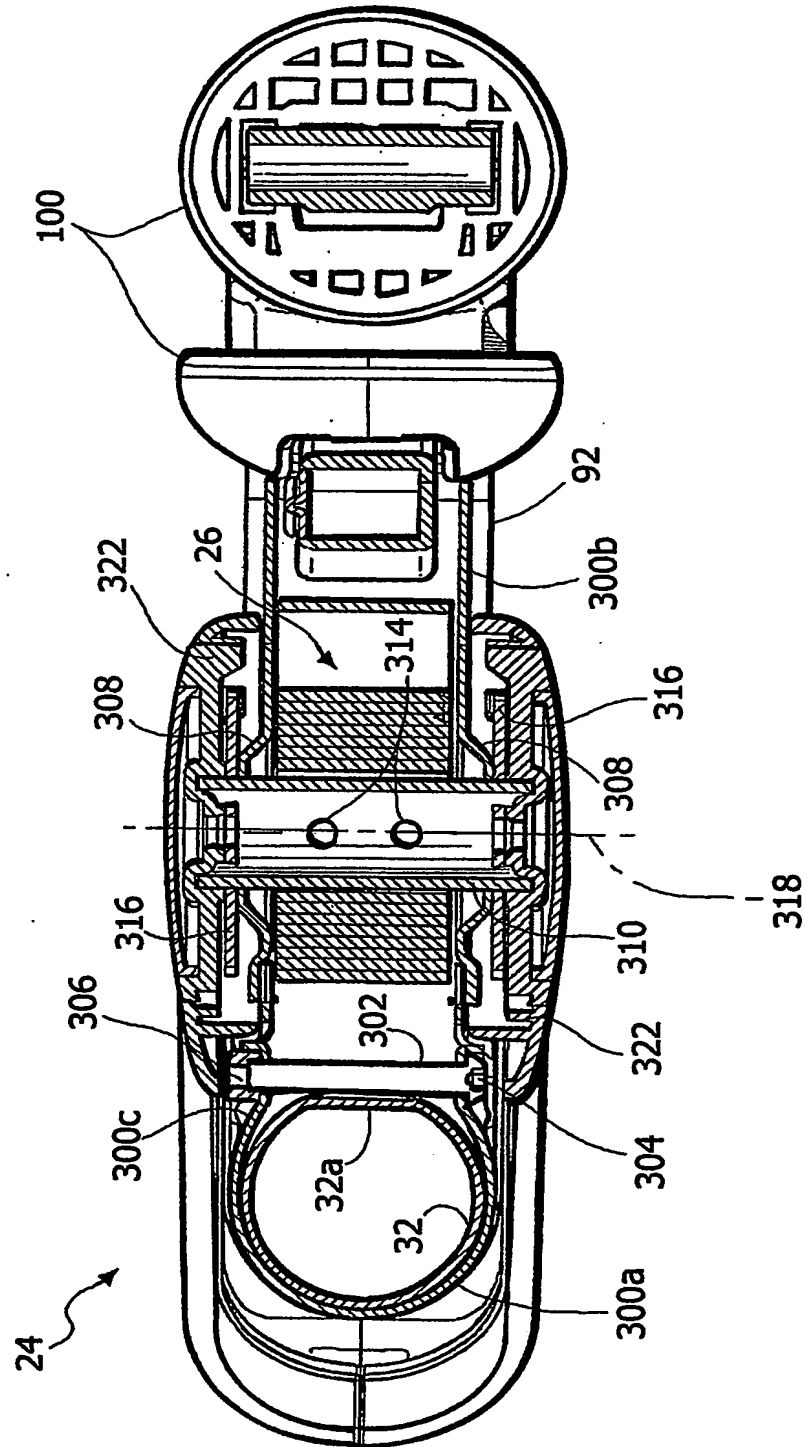




FIG. 21

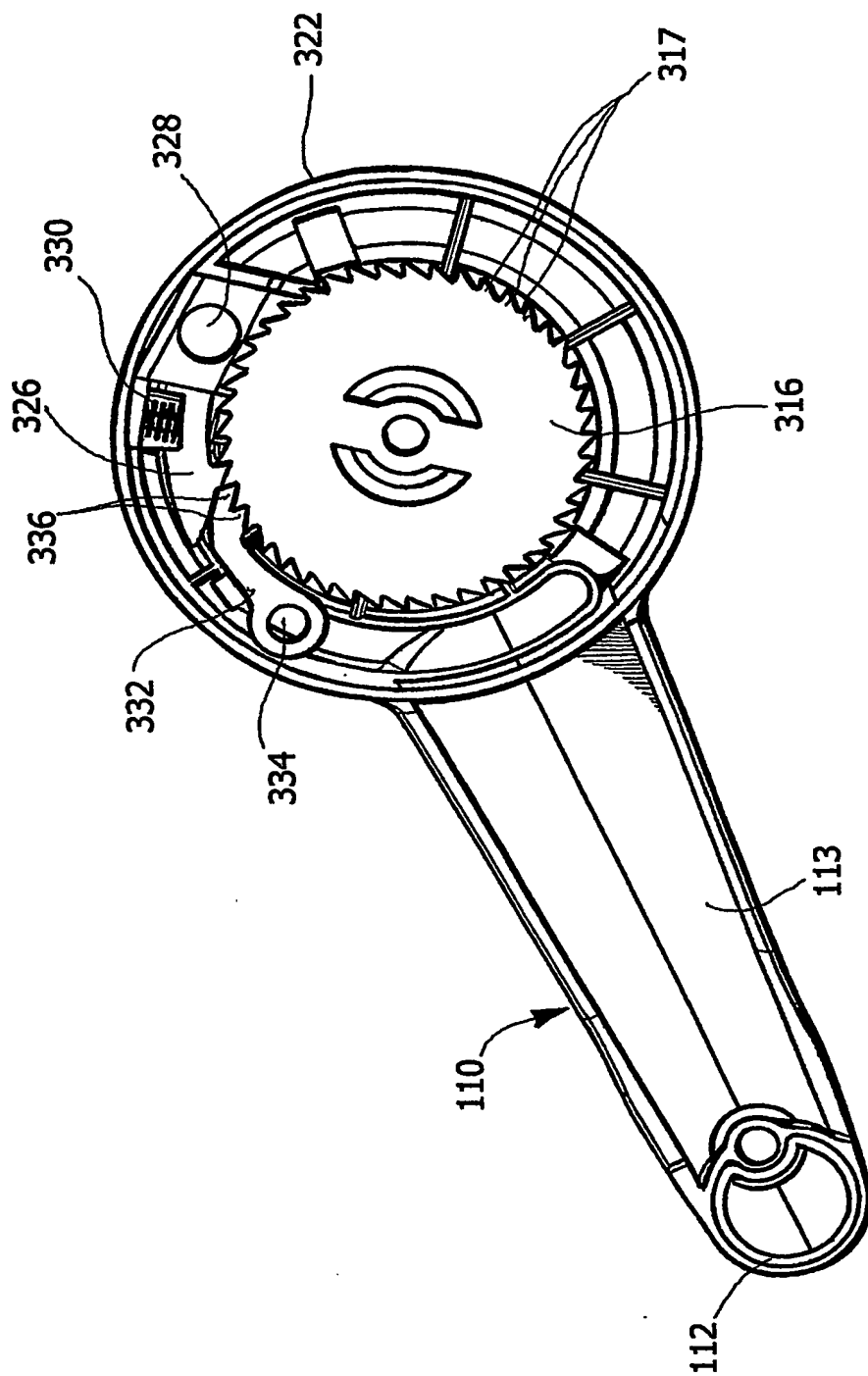


FIG.22

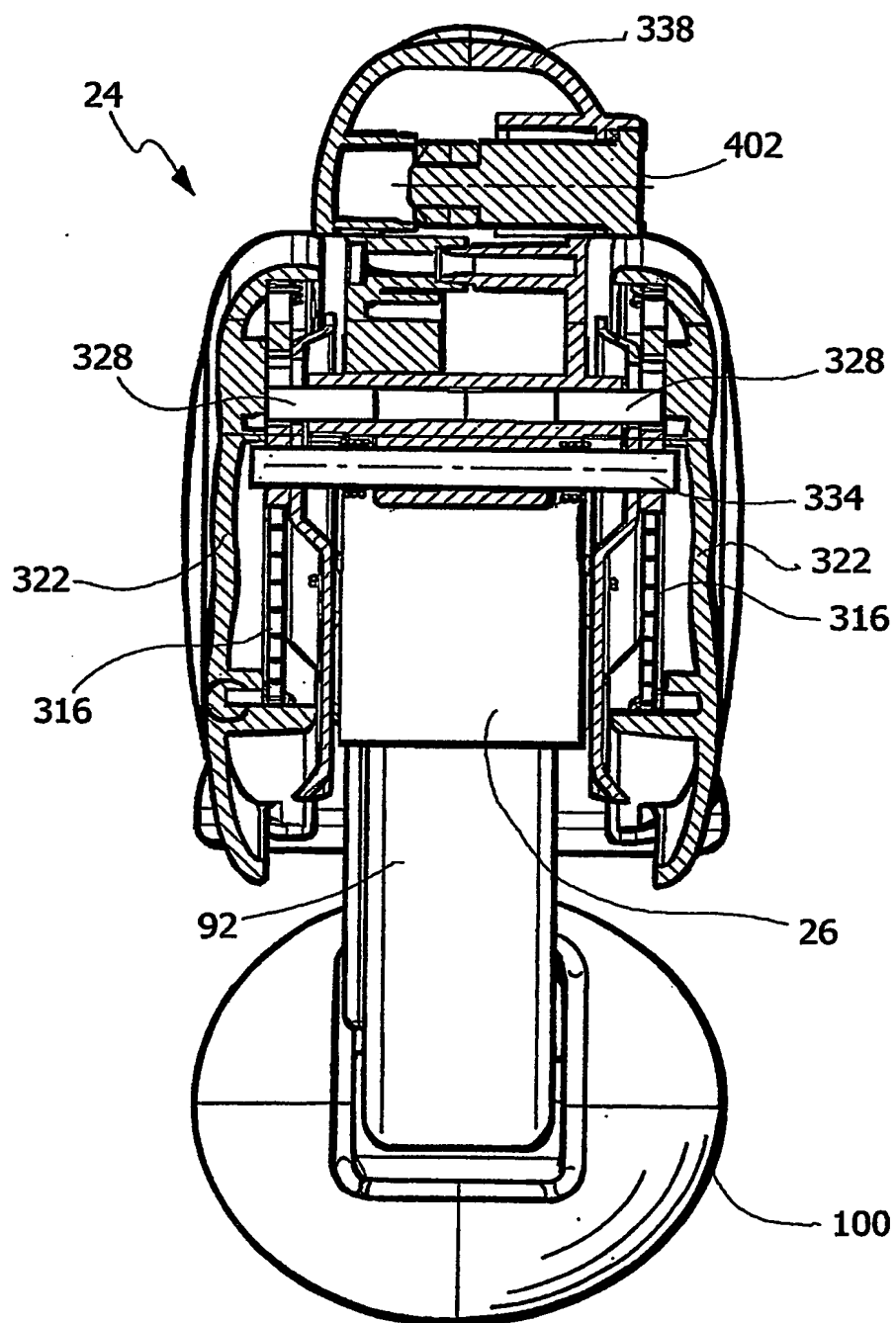


FIG.23

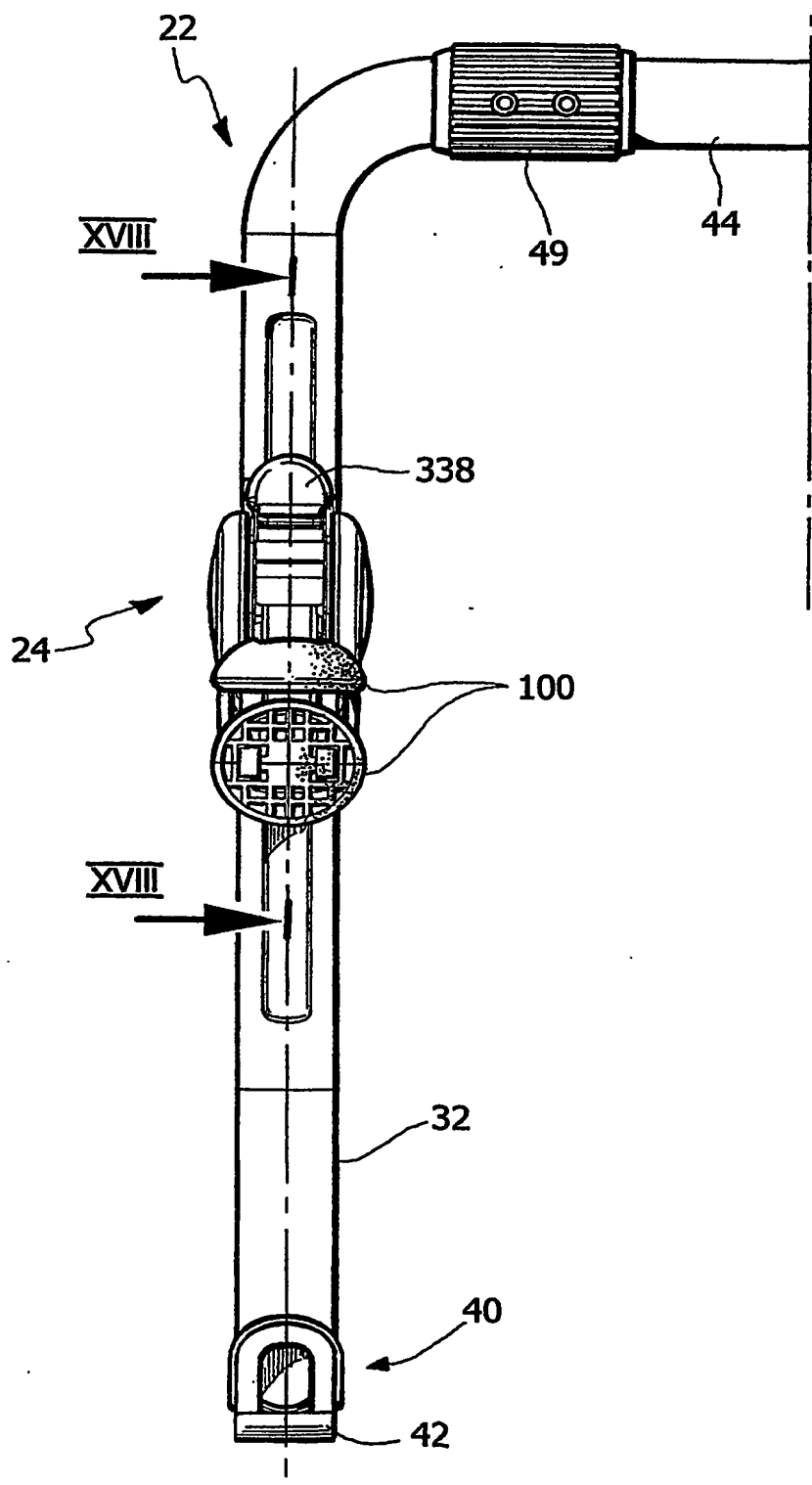




FIG. 24

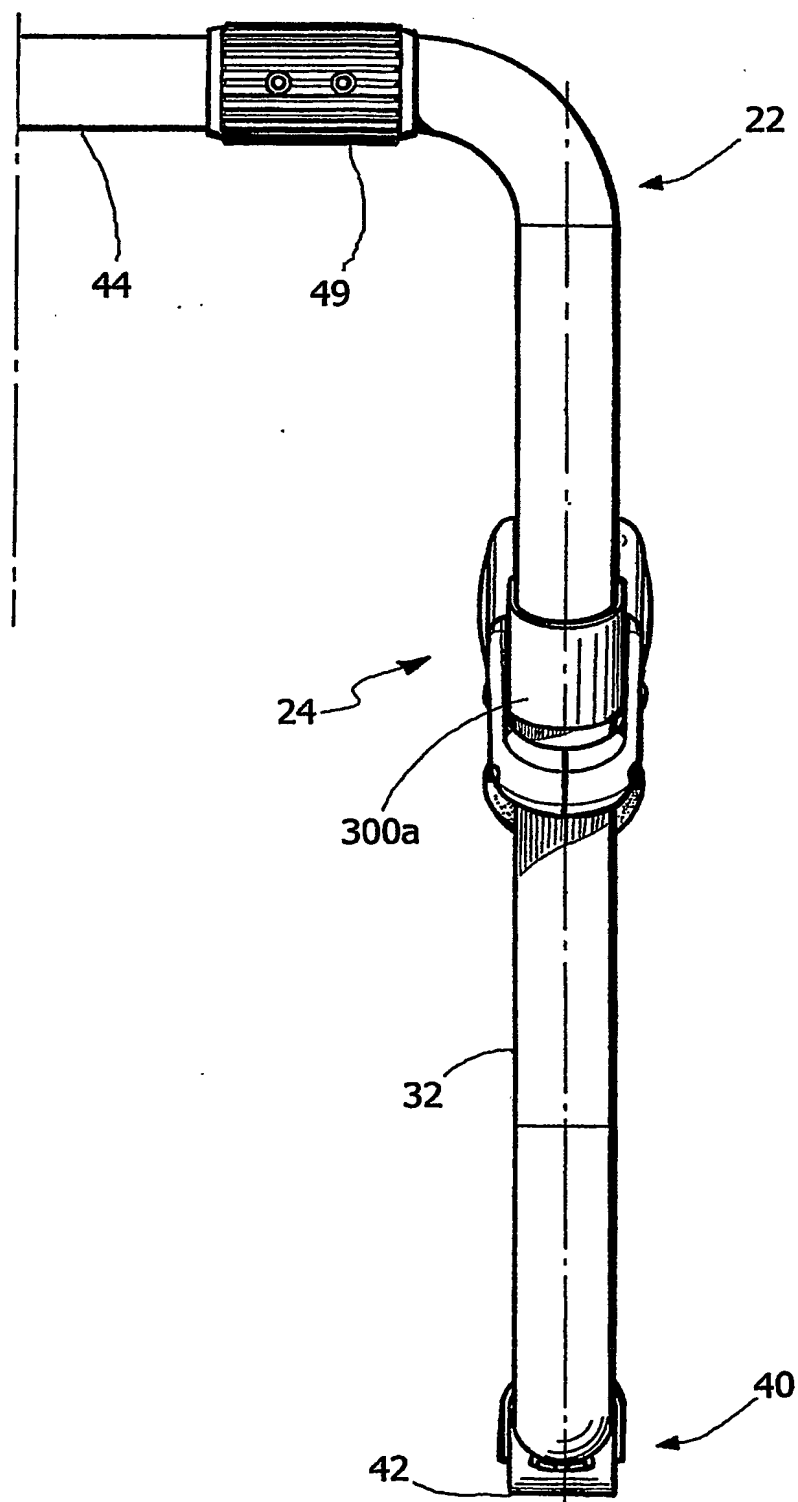


FIG. 25

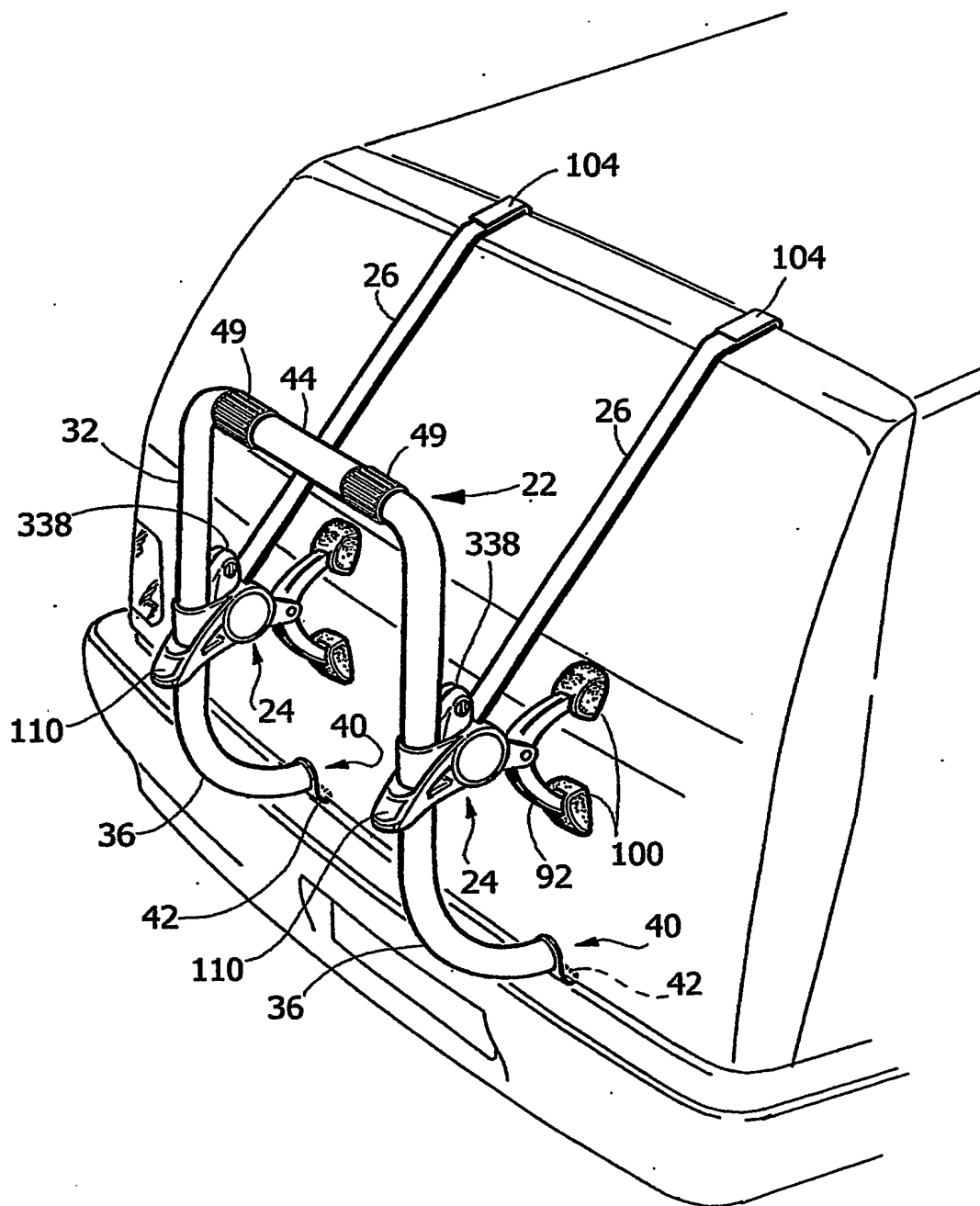


FIG. 26

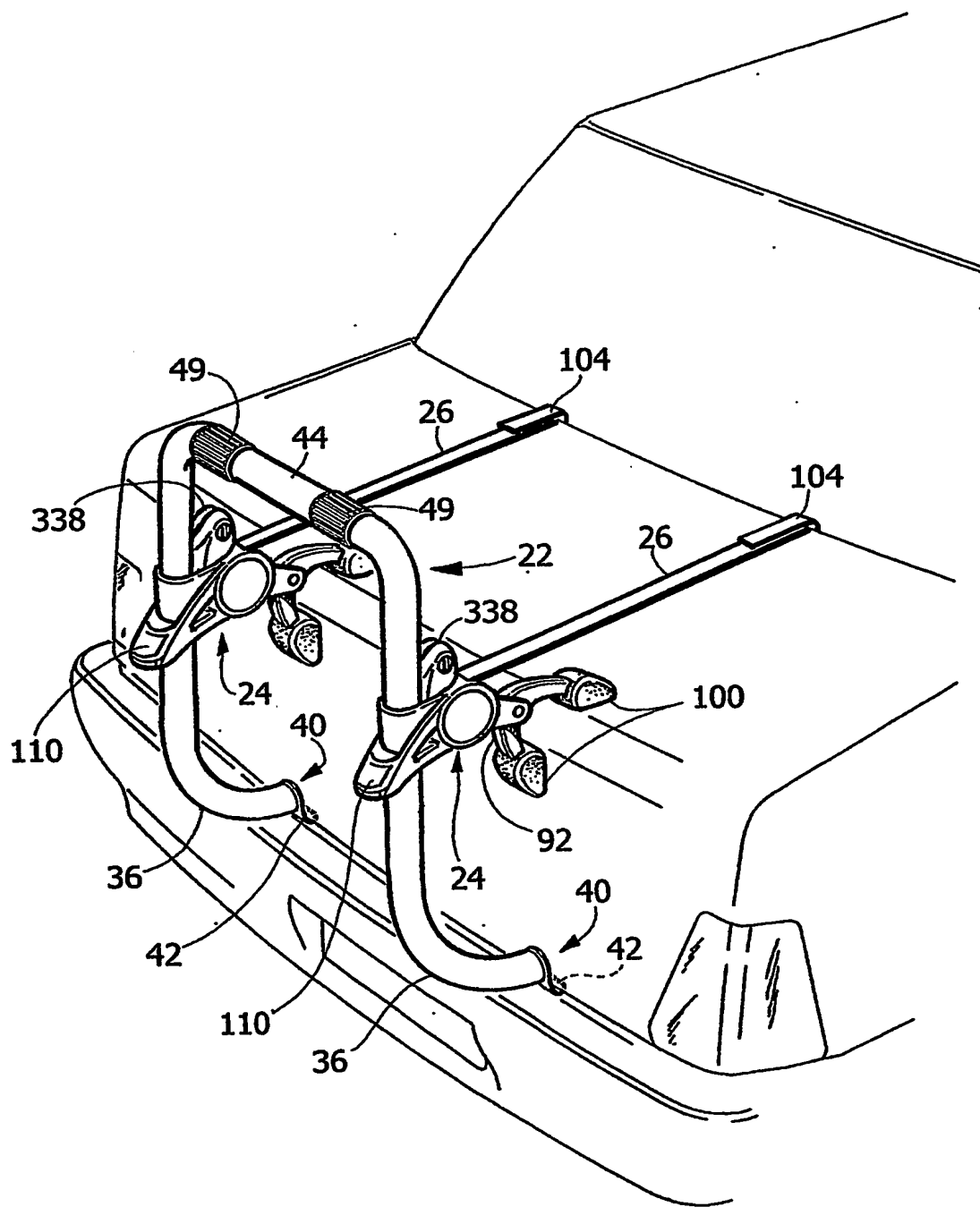


FIG. 27

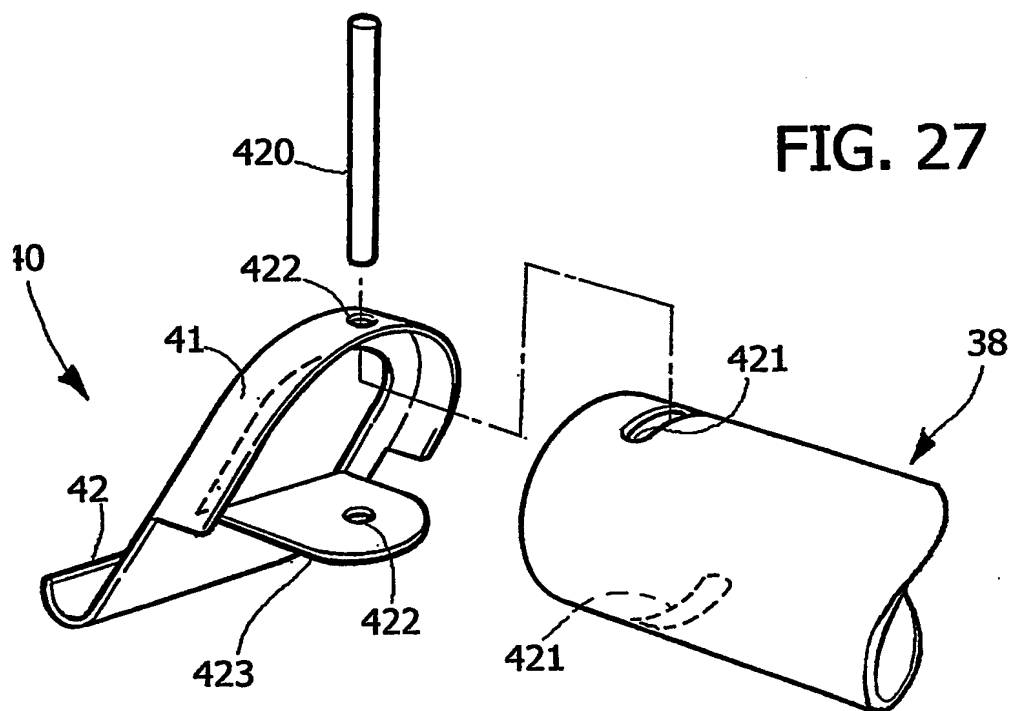
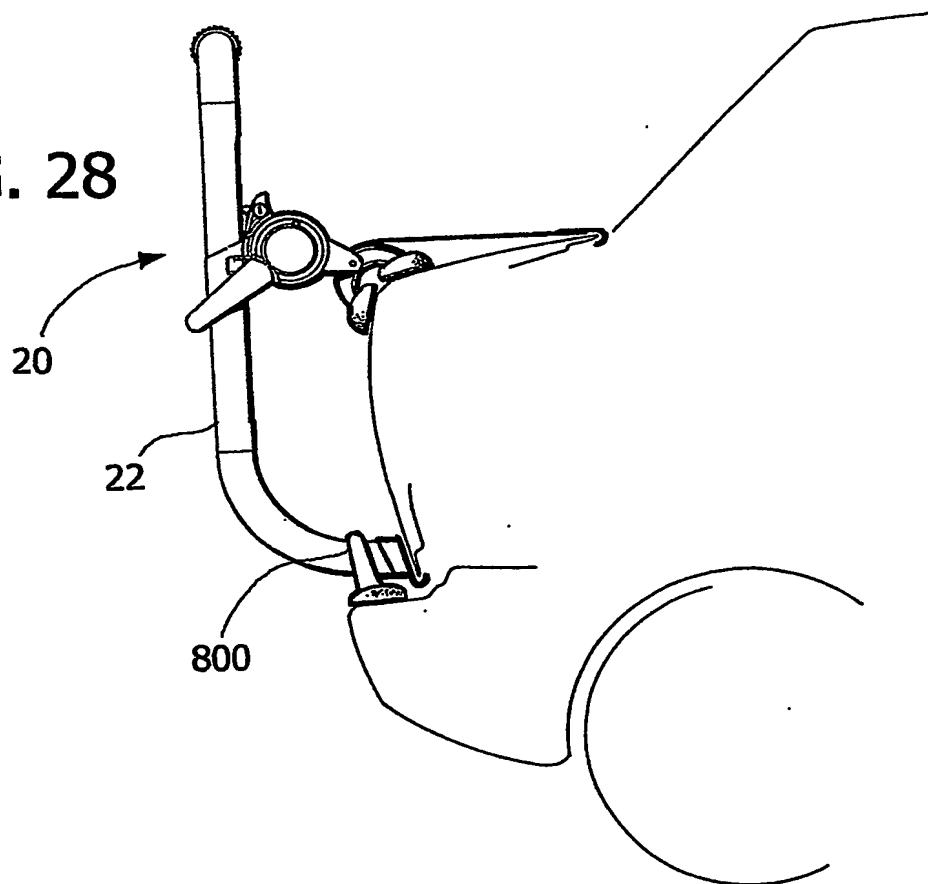


FIG. 28



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